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CITY COUNTY STATE

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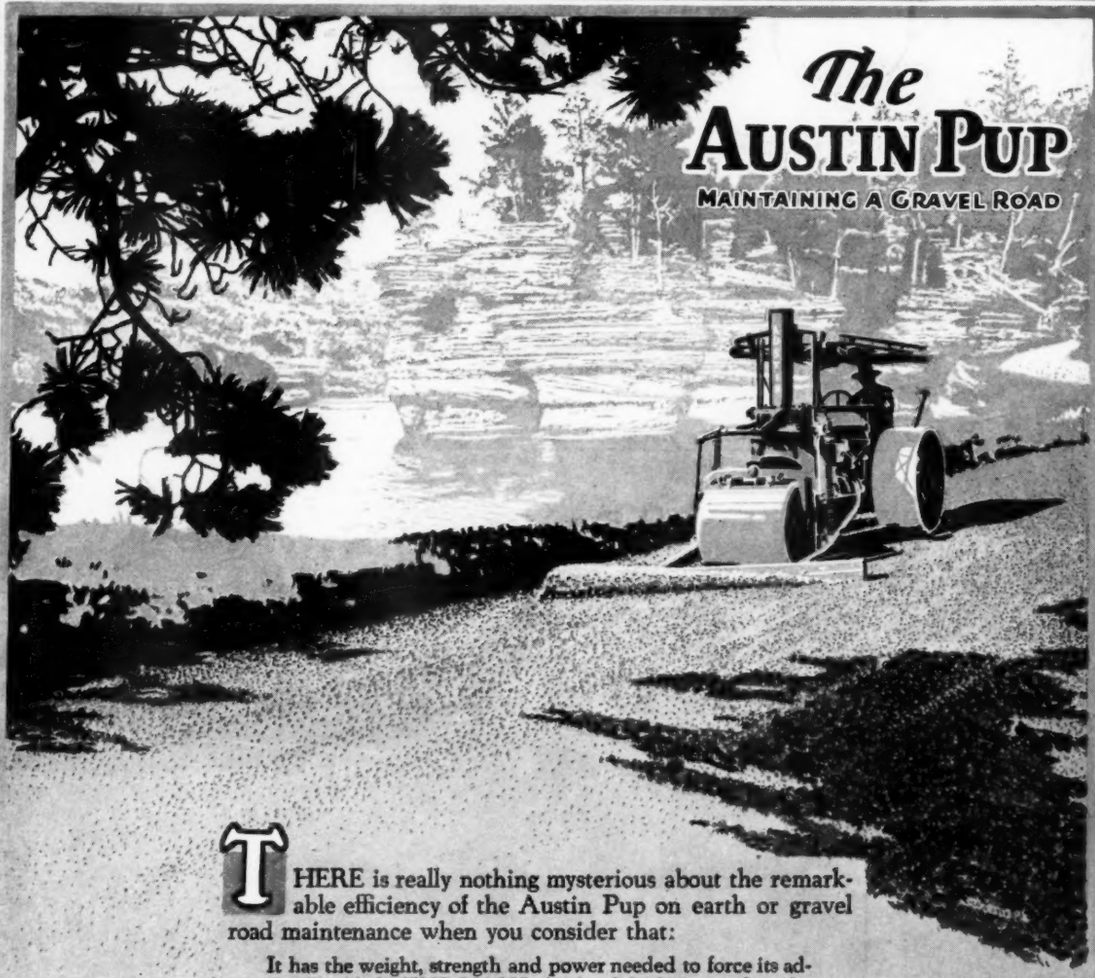

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Traffic Problems and Suggested Remedies

Providing Parking for Automobiles, Increase of Traffic Beyond Street Capacity and Poor Street Planning are the Chief Problems Reported. Two Hundred City Engineers Suggest Remedies

In a questionnaire sent last month to city engineers and similar officials of cities of more than 10,000 population, two of the questions asked, and the ones to which we received some of the most interesting replies, were: "What are your principal problems of street layout and design caused by increasing traffic?" and a companion question: "In general, what changes in street layout and design do you think will be needed in American cities to accommodate increasing traffic?"

STREET PROBLEMS DUE TO TRAFFIC

One hundred and thirty-one cities reported that their most important problems were occasioned by parking and narrow roadways. It is probable that in a great many cases, if not the majority, the insufficiency of roadway width was due solely to parking, so that approximately one hundred cities found their chief difficulty in the parking in business districts or other congested districts. Two of these took especial exception to diagonal parking, one stating that it was permitted by the police against the protest of the street department. Another found that automobiles standing in front of business houses for loading and unloading was a serious problem. The difficulties connected with parking brought out many suggested solutions which will be referred to later on.

Next to parking, the most common problems were those connected with traffic. In further specifying the objectionable features, eight cities reported that their street layout had been poorly designed; nine have too few thoroughfares and one has too few cross streets; two have trouble with dead-end streets; three with an insufficient number of river bridges and approaches. Four report traffic difficulty from heavy grades, six from street railway tracks in the busy thoroughfares, and four from railroad crossings.

Sixteen report having dangerous intersections, one from the acute angle of intersections; nineteen refer to short radii of curbs at corners, and two to "blind" corners, or those in which buildings or other obstructions interfere with the view.

One finds that old raised crosswalks delay traffic and two refer to poor drainage. Ten state that inadequate pavements present a traffic problem, while another complains of the cost of pavement maintenance under heavy traffic.

Others find as very serious problems the cleaning of crowded streets, delay to automobiles by slow moving farm wagons, cost of street administration, securing funds for widening streets, and creating public sentiment for such improvements.

Four report difficulty in enforcing traffic laws and one finds a lack of judgment in the city officials and selfishness in individual citizens which interfere with carrying out solutions of such problems. Los Angeles, Calif., does not find the physical problems so difficult, except on hillsides, but finds its chief problem in the cost and difficulty of keeping the highways in proper condition under their increased use by motor vehicles.

A number of cities are in a sufficiently fortunate position to be able to report that they have no problems of this kind. City Engineer G. H. Sargent, of La Grange, Ga., states that in that city all streets radiating from the business center have been so laid out and constructed that any widening necessary can be done by simply setting the curbs back to give a width of 56 feet of roadway. At present the roadways in the residence sections are 30 to 36 feet wide, which is found to be ample.

A directly opposite condition is found at Anderson, Ind., concerning which city engineer M. H. Downey says: "Streets have been built with narrow pavements and with sidewalks adjacent to curbs, and property owners have encroached upon space left between sidewalks and property line. This causes roadway widening to be resisted by the property owners."

Concerning traffic, L. M. Hastings, city engineer of Cambridge, Mass., says: "The principal problem is the increased concentration of traffic in certain main thoroughfares and at certain intersections. This concentration is both diurnal and seasonal, varying

greatly with the time of day and season of the year. This problem is increasing in gravity at a rapid rate."

REMEDIES SUGGESTED

The remedies suggested by the various city engineers far outnumber the problems named and would seem to very well cover the field of possibilities as at present apprehended. Several stated, what probably most would assent to, that in most respects each city presents problems of phases of problems differing from every other and that, therefore, a separate study should be made of each case. While this is true, an inspection of the remedies suggested by about two hundred city engineers, although many of them undoubtedly were devised to suit the local problems, should offer valuable suggestions for most of the conditions to be found in almost any other city.

The remedies suggested may be divided under the heads of physical, traffic, parking and general.

Physical. Under the physical remedies, that most generally suggested was widening of roadways, 95 including this; while two others recommended adjusting width to traffic requirements, which probably meant the same thing, as the recommendation for widening roadways undoubtedly was meant to apply only to those where the present width was not sufficient for the traffic. In discussions of this subject, the pedestrian is generally overlooked, but one city engineer had him in mind and suggested wider sidewalks.

In connection with street intersections, five recommended more room at such intersections, six recommended separation of grades and one "raised intersections," and another "circular intersections;" while one advised against multiple street intersections and two recommended limiting to a minimum the intersections of traffic thoroughfares.

Other suggestions for treating street intersections were: Lengthening the radii of the curb at corners, suggested by 28; removing vision obstructions (7 cities), one specifying the elimination of trees and shrubbery and another the keeping of buildings back from the property line corner. One called attention to the danger of jogging street intersections.

Twenty-five, probably basing their recommendations on conditions in their own cities, advised more thoroughfares, while eight advocated radial or diagonal thoroughfares, and one multiple sub-center foci for decentralizing traffic, while three recommended decentralization without specifying any definite means. Two advocated alleys paralleling business streets in which loading and unloading of trucks could be performed.

Concerning the roadways, one specified flat crowns, one non-skid pavements, and ten believed better paving was necessary, about half of these particularly specifying heavier bases, while one would pave all main thoroughfares with asphalt and another with concrete. Poor drainage was believed by three to interfere with the best traffic conditions, and one thought better grades desirable.

Arcade sidewalks were recommended by four; a central parkway to divide the two traffic lines by one; safety zones at crossings and street-car subways were each suggested by one; and the elimination of railroad crossings and putting street-car lines outside of the paved part of the street by two each.

Traffic. In the matter of regulating moving traffic, one-way streets seemed to be the most popular remedy, being advocated by twenty-two. The next most popular consisted in keeping through traffic out of the business center of the city, seventeen so recommending, while four others would carry tourist thoroughfares entirely around the city. Segregation of traffic was specified generally by eleven, while seven others would designate heavy traffic streets and four would set aside certain streets for rapid traffic. Two recommended boulevard stops, or the stopping of all vehicles before crossing certain designated boulevards. Three recommended that at the intersections of thoroughfares left-hand turning be prohibited. Control of pedestrian traffic was thought

MARION STREET, OAK PARK, BETWEEN NORTH BOULEVARD AND LAKE STREET.

Business center and very busy section. Thirty feet between curbs. Numerous accidents due to vehicles trying to pass each other with cars parked on both sides.

desirable by one, while another would devise some scheme by which pedestrians could cross streets and board trolley cars without holding up traffic (the scheme was not particularized). Other suggestions were the adoption of circular traffic at intersections, the general distribution of printed traffic rules, the use of traffic signals, while thirteen believed there was need of more strict enforcement of traffic regulations.

Parking. As stated above, a number of cities find it a serious problem to prevent parking or offer any substitute for it. Quite a number of those suggesting remedies believed that improvement was necessary in the general parking plans or lack of plans found in most cities.

Seven recommended muncipal parking areas and two municipal garages, while two others suggested multiple-story garages without specifying that they be municipal. Eight would require that all parking be outside of the street limits, three on side streets only, two in the center of the street where possible so as to leave the curbs free, and one on one side of the street only. Although some had reported diagonal parking as one of the undesirable features to be avoided, one suggested it as a remedy. Another suggested the formation of parking areas in the interiors of blocks. Still another would require the industries in a given district to provide parking spaces for that district. Seven believe that more stringent limitations of parking time should be enforced.

General. Among the general suggestions were six advocating city planning and two advocating zoning; while two others would limit the height of buildings, two would establish building lines, three would adopt setback lines so as to minimize the cost of future widening, and one would prevent infringement on street space by private structures. Adequate rapid transit was suggested by one as tending to minimize the number of private vehicles. Finally, one suggested that there should be a general move of the population into a greater number of small towns rather than increasing the number and size of the larger cities.

SOME INDIVIDUAL SUGGESTIONS

The majority of the replies did not confine themselves to only one of the above suggestions but made several more or less related ones. For instance, Howard B. Carter, city engineer of Santa Monica, Cal., recommended flat crowns, wide roadways, long curb radii, few intersections, arteries parallel to main thoroughfares, ample parking facilities, non-skid pavements, ample drainage, the designation of portions of roadway as speed lanes, and boulevard stops at all main thoroughfares.

P. L. Brockway, city engineer of Wichita, Kans., suggested the entire exclusion of cars privately operated by individual owners from the most congested areas.

L. M. Hastings, city engineer of Cambridge, Mass., believes that "the most effective remedy for the bad traffic conditions existing in so many cities is dispersing traffic into as many channels as possible. Widening and improving a thoroughfare but invites more traffic and renders the problem of street intersection crossings an almost insolvable one. Making it possible to reach an objective by more than one route is, I believe, one of the most feasible remedies."

Concerning parking, George F. Nye, city engineer of New Bedford, Mass., says: "The removal of standing cars automatically widens a roadway 18 feet without expense. Compare this with the cost of widening a street in a business district. Slogan: 'Keep them moving.'"

L. G. Lenhardt, city engineer of Pontiac, Mich., believes that the spider-web street layout should not be used, but, while radial arteries have their advantages, they should not all converge at a central point.

A. W. Bedell, city engineer of Faribault, Minn., suggests so placing the curb on residence streets as to leave space between it and the sidewalk for vehicles to park.

A. C. Godward, city planning engineer of Minneapolis, Minn., says: "Increasing traffic cannot be adequately provided for by street design in existing cities, and each street system will gradually reach a saturation point. The Minneapolis plan is based

MARION STREET, OAK PARK, BETWEEN SOUTH BOULEVARD AND PLEASANT STREET.
Widened from 32 feet to 42 feet. Allows diagonal parking on one side, straight parking on the other, and plenty of room for two lines of moving traffic.

upon decentralization of traffic, with bypass streets for through traffic and limitation of the height of structures." Several others seem to have reached a similar conclusion, that it is impracticable to make thoroughfares so wide that traffic will not crowd them, some almost uttering a note of despair at the apparent impossibility of ameliorating conditions.

J. D. Blackwell, city engineer of Seattle, Wash., considers the problem a very difficult one and says: "I could take a map of Seattle and show you a possible, indeed, immediately probable, traffic in many directions from six to ten times the maximum capacity of all the streets that could possibly serve it."

In recommending segregation of traffic through different streets, one engineer believes that the city, in building special pavement designed to carry heavy trucking, should receive federal or state aid.

J. J. Smith, city engineer of Grand Forks, N. D., reports that the city is paving a short street 300 feet long running from the main street to the river to be used for parking purposes, but thinks a garage of several stories will be needed.

Thomas Fennie, city engineer of Monessen, Pa., suggests that car tracks separated by a curb or sidewalk from the roadway would permit greater speed for the street cars and prevent the confusion caused by cars and automobiles interfering on the same right-of-way.

M. H. Bronsdon, commissioner of public works of Providence, R. I., says: "Traffic should be separated into three groups, each to have its lane through or around the congested section of the city, these groups being: (1) street cars, (2) passenger automobiles, and (3) auto trucks and horse-drawn vehicles. At intersections, one street should pass under the other in order to avoid grade crossings"

C. B. Coe, commissioner of streets of Johnson City, Tenn., believes there should be direct routes for connecting the various sections of the city without passing through the mercantile district.

Limited Parking in New York

In connection with the above, recent action in New York City is interesting. Beginning June 10, the Police Department prohibited parking of vehicles for more than twenty minutes at any point in a number of the north and south thoroughfares, and beginning on June 18, a number of crosstown streets will be set aside as one-way express streets, where no parking will be allowed. The restriction applies to those who live or do business on the street as well as to others. "Cruising" of taxicabs and hacks on these streets is forbidden also.

The avenues include Fourth, Madison, Fifth, Broadway, Seventh and Eighth Avenues, between certain northern and southern limits. The regulation will be in force from 8 A. M. to 8 P. M. and to midnight on Broadway.

Width of Streets

Summary of Figures Given in Table on Page 202 as to Widths of Main Thoroughfares, Business and Residence Streets

Information was received, by means of the questionnaire previously referred to, from 233 cities concerning the widths of their business streets, main thoroughfares and residence streets. In quite a number of cities, as was to be expected, the widths of the streets did not appear to have varied in accordance with any assumed or foreseen use of them. In fact, in a great many of the older and smaller cities there seems to have been no idea whatever of differentiating between the streets in fixing street widths.

While main thoroughfares should provide abundant width for moving traffic, ordinarily sufficient for four lanes of traffic where this is at all considerable, business streets need additional width for parking, and this demand has increased enormously during the past few years. There are probably few municipalities in which the parking demands in the business section are not so great that only where the business streets are of unusual width is there freedom from congestion and annoyance on this account.

Comparing the widths of the business streets and the main thoroughfares in the cities reporting, we find that in only 56 cities, or 24 per cent. of the whole, are the business streets wider than the main thoroughfares, taking the average width of each for each city. In just half the remainder, or 38 per cent., the average width of business street was the same as that of main thoroughfare, while in an equal number, or 38 per cent., was the average width of business street less than that of main thoroughfare.

Examining these figures by districts, we find that the average width of business street is greater than that of main thoroughfare in 21% of the New England cities reporting, in 14% of of the Middle Atlantic, in 31% of the East North Central, in 31% of the West North Central, in 27% of the South Atlantic, in 33% of the East South Central, in 36% of the West South Central, in 8% of the Mountain and in 18% of the Pacific. From these figures it appears that the highest percentages of wide business streets are to be found in the four central groups of states; the next highest percentages in the South Atlantic; and following this, the New England states. In the Mountain and Pacific states considerably more than half of the cities have equal widths for both business streets and main thoroughfares.

Considering the parking demands in the business sections of cities, it would seem very probable that a great many cities are already feeling the necessity of widening the roadways in the business districts or of finding some alternative for providing parking space for those visiting such district for business or pleasure.

STREET WIDENING

Other questions asked in the questionnaire

were whether the city in question had widened any of its streets because of traffic difficulties, was at present widening any for this purpose, or was proposing to do so. Seventy-one, or 30% of all reporting, stated that they had already widened one or more streets in the city—several of them quite a number of streets. Some stated specifically that they had widened not the entire street but the roadway only, and it is very probable that many others had confined the widening to setting back the curbs, although it is impossible to state just how many. An examination of the figures given as to the cost of the work, however, would suggest that fully half the number referred to roadway widening only.

Forty-one cities reported that they are at present carrying on construction work in street widening, and forty-three have definite projects of street widening in contemplation, most of them having gone at least as far as estimating the cost, while others have purchased or are now purchasing the property needed for widening the streets.

It would appear from these figures that about half the cities have already reached the point where increasing traffic has compelled them to spend or decide to spend large sums of money in widening their streets. Presumably most of the others have felt the same urge to a greater or less extent, but it has not yet become so insistent as to bring them to the point of spending the large sums involved.

Several cities stated that advantage was taken of the repaving of streets to widen the roadways. For example, Clinton, Ia., stated that in repaving one avenue the roadway was widened from 40 feet to 64 feet and that two more blocks will be widened when repaved.

City Planning

Planning Commissions, City Plans and the Extent to Which Such Plans Have Been Carried Out. Summary of Information Tabulated on Page 204

During the past few years the idea of having a comprehensive city plan prepared has been adopted by a large and increasing number of cities, and several of the states have taken recognition of the idea to the extent of passing laws permitting, regulating or otherwise providing for action by their municipalities looking towards the obtaining of a city plan.

Of 233 cities replying to a questionnaire on the subject last month, 110 report having planning commissions, two of which have just been appointed. Two are said to be advisory only, and possibly others would come under this designation, and two are reported as not functioning, and this number also could probably be increased.

Seventy-five cities report that city plans have been prepared. The modern growth of the idea is indicated by the years in which these plans were completed. Thirteen of the 75 are still at work upon the plans, in some cases no more than a beginning having been made. Fifteen, or 20%, of the plans were completed in 1923; 8 in 1922, 7 in 1921, 6 in 1920, 10 in the years 1915 to 1919 inclusive, 8 in the years 1910 to 1914, and only 3 before the year 1910.

Of the 75 cities for which plans have been prepared, 21 have carried out none of the features of these plans and in some the entire plan has been pigeon-holed and probably forgotten by the majority of citizens as well as officials. Some of the plans are being carried out quite completely, while in quite a number of other cases only some of the simpler and least expensive of the recommendations of the plan have been put into effect.

The question was asked whether the city had any official plan for the future street layout. In some cases such plan would be a part of the comprehensive city plan referred to above, but the street plan might be prepared without any reference to a comprehensive city plan, while on the other hand the city plan might not go into the details of the street layout except in possibly a few main thoroughfares. Only about 20% of the cities reported having a future street layout for the entire city or even for a part of it. Fourteen cities, however, reported that such a layout was now being made or studies were being carried out with a view to making it.

TRAFFIC STUDIES

The streets are, of course, made to carry traffic and theoretically the dimensions of the streets, nature of the street surface and other details should be dependent largely upon the amount and kind of traffic to be carried. In spite of this relation, however, very little is known definitely in more than two or three cities concerning the traffic carried by its several streets, although a study of this subject is now being taken up by a number of cities. Sixty-six cities, or more than a quarter of the entire number, reported that they had made traffic counts to be used in connection with street planning, although in most cases these were confined to a few locations only and in some cases to only one count made at a business center or railroad crossing.

A greater number of cities, 84 in all, reported that special studies had been made of traffic conditions. In quite a number of cases it was specified that these studies had been made by the police department, indicating that they were made with a view to the control of traffic rather than to the adjustment of roadways and other details for the carrying of such traffic. In other cases traffic counts and traffic studies had been made unofficially by boards of trade or other organizations of citizens, in some cases using boy scouts for making the traffic counts. In a few cities, however, these traffic studies have been made, or are being made, by the experts employed as city planners in connection with their report to the city on the subject of a comprehensive city plan.

One reason, probably, why traffic studies have not been carried out more carefully or with

more favorable results is because of the peculiar nature of traffic. In other matters, such as the amount of water for drinking, we can base some conclusions on counts of present and estimated number of future consumers. Since the advent of the automobile, however, the amount of traffic carried by a main thoroughfare seems to be dependent largely upon how many the thoroughfare can carry. Increasing the width of roadway and making possible an additional lane of travel each way will in many cases find the added capacity entirely taken up within a few months, either by diversion from other less favorable routes or by actual increase in the use of cars by those living in and passing through the city in question.

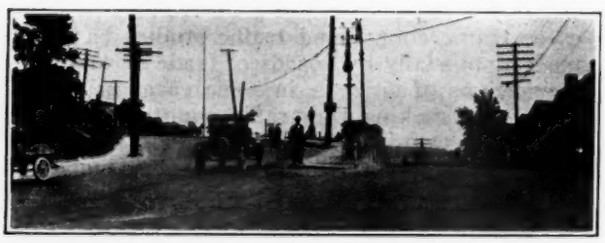
Just how this problem can be solved and what provision should be made for future increase in traffice it is difficult to state definitely, and to this extent a count of present traffic might seem to be void of direct results or even of value. However, it is undoubtedly an important factor in the study of the problem and is a very necessary one, even though it does not immediately and directly point the way to a definite solution of it.

Street Widening in Wilkinsburg

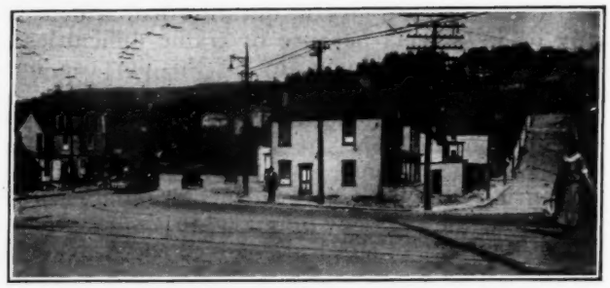
Nearly a Mile of Thoroughfare Widened from Forty-four to Sixty Feet and Wires Placed Underground to Provide for Concentrated Traffic Passing Through This Borough

By Charles F. Sperling, Borough Engineer

The topography and geography of Wilkinsburg combine to make the traffic problem of that suburb of Pittsburgh a most difficult one. Pittsburgh is surrounded with hills, cliffs and deep ravines which limit the number of thoroughfares leading to it and tax the engineer to render easy for traffic those that are available. Several deep valleys extend north and south from the city but only one extends easterly and this one leads to the borough of Wilkinsburg; making it what the motorists call "the neck of the bottle" of Pittsburgh traffic. Three important traffic arteries of Pittsburgh, only 300 feet apart in the business section, converge to this bottle neck, and two other main thoroughfares of that city also lead to the borough named.



INTERSECTION OF LINCOLN HIGHWAY (AT THE RIGHT) AND WILLIAM PENN HIGHWAY (AT THE LEFT).



SWISSVALE AVENUE AFTER IMPROVEMENT.
Looking east along portion cut through between Burns Street and Glenn Avenue.

The Lincoln Highway extends east and west through the borough, with a width of 60 feet for about 1½ miles and with a maximum grade of 7½ per cent for 600 feet. The William Penn Highway intersects the Lincoln Highway at about the geographical center of the borough, but has been in an impassable condition because of its steep grades (there is a continuous 9 per cent grade for 3,000 feet easterly from the Lincoln Highway), improper location at places and neglect. This will be remedied by the State Highway Department by a change of location, reducing the grades and paving, some of which work is now being done and will be completed by the first of next year. When completed, this will add considerable traffic to that passing through the borough.

About 600 feet west of the intersection of these two highways is located a street named Swissvale street which is a main traffic artery for travel between points along the Allegheny river and Pittsburgh. It was originally a street 44 feet wide paved 24 feet between curbs, and double street-car tracks built in it left only about 4½ feet between rail and curb. This condition had resulted in such frequent tieups of street-car and vehicle traffic that relief of some kind became absolutely necessary. The Council realized that such relief was necessary and also that it would be necessary before long to relieve traffic on the William Penn Highway, and, therefore, decided to widen the street 60 feet and also locate and open a street between blocks to connect Swissvale street to another called Montier street, which also was widened; this construction, when completed, making one continuous thoroughfare.

The improvement of Swissvale avenue was started and completed last year at a cost of several hundred thousand dollars. For a length of nearly one mile the distance between curbs was made 44 feet and the width of sidewalks 8 feet. No difficult engineering problems were encountered here. The buildings were all moved back from the line of the improvement, after which sewers were constructed and connected with each house, and telephone and telegraph poles were replaced with conduits. All ditches were refilled with granulated slag from a point

two feet above the pipe. The old rails of the street-car tracks were renewed with new ones and new ties.

The Ligonier block stones were reclipped and used for repaving between tracks and rails and for one foot outside of same. The foundation of the pavement consists of 8 inches of concrete mixed 1:2½:5, on which was placed a 1-inch cushion of river sand, and on this 4 inches of brick with asphalt filler laid according to the specifications of the National Paving Brick Manufacturers Association. This construction is, in my opinion, one of the best used today for heavy traffic. The cost per square yard of the paving was $4.34, which includes the foundation. Grading cost $1.25 per cubic yard and sidewalks 30c. per square foot.

SWISSVALE AVENUE AS IMPROVED; LOOKING NORTH FROM LINCOLN HIGHWAY.

It was found after this improvement had been completed that it had stimulated building, many houses having been constructed solely because of the improvement, and as many as one hundred houses will soon have been erected in one small section. The improvement has added materially to the value of property adjacent to it.

There is no question that improvements of this kind on a large scale change the complexion of the vicinity, adding considerable to the appearance of the place, keep up with traffic requirements, make the locality more convenient and desirable, and last but not least, by stimulating building, soon pay back in increased valuation on the property and buildings the major portion of the money that the municipality has expended upon it.—This last benefit is one that is generally overlooked by both taxpayers and councilmen.

Waterworks at Marlin, Texas

We are informed by Levi Goodrich, city engineer and superintendent of waterworks of Marlin, Tex., that that city is now installing a new water supply which involves the construction of a reservoir of 700 million gallons capacity located on the Big Sandy Creek watershed; a rapid sand filtration plant being constructed by the International Filter Company and the Bart Moore Construction Company of Waco, Tex.; and a pumping plant furnished by the Fairbanks-Morse Company and consisting of two units each with a capacity of one million gallons per day. This entire plant is now practically completed.

Construction has required about two years and the cost of the plant has been about $225,000.

Ice Damages Concrete Reservoir

A peculiar instance of damage to a concrete lined reservoir by ice has been reported from British Columbia. During most of last winter the water level was maintained fairly constant, but during intermittent spells of below-zero weather the water supply ran low and caused a fall in the reservoir level. Snow and ice had formed to a thickness of 3 feet on the reservoir and extending fully 20 feet out from the banks and frozen to the concrete lining. When the water fell, the weight of this snow and ice was so great that it fell, dragging the top of the lining with it, the lower edge of the rim of ice forming the fulcrum about which the concrete revolved. To safeguard against similar occurrences it is proposed to erect reinforced concrete columns and tie beams, suitably spaced, affording ample support when the water is lowered.

SWISSVALE AVENUE SOUTH OF PENN AVENUE.
To be widened to 60 feet. The part north of Lincoln Highway looked like this before widening, except it was double-tracked.

Separate Sludge Digestion*

Advantages of separation of mechanical sedimentation and biological digestion, as compared with combining both processes in septic or two-story tanks. Some principles of design.

By W. DeWitt Vosbury†

In presenting this paper, it is the intention to compare the relative merits of two processes of sludge digestion; namely, that which takes place in tanks wherein sedimentation of sewage and digestion of sludge are combined and that consisting of the digestion of sludge in tanks utilized for that purpose.

There are two distinct types of tanks which are most commonly used for the combined process of sewage sedimentation and sludge digestion. The first of these groups is represented by the single-story septic tank and its numerous modifications. Comprising the second group are the two-story tanks such as the Travis, Kremer and Imhoff Tanks. The latter is used extensively throughout the country.

Some of the objectionable features inherent with tanks combining both sedimentation and sludge digestion may be summed up as follows: In septic tanks there is interference with sedimentation through disturbance by rising gas bubbles; over septicization and unloading or the passing out of sludge particles in the effluent. In the two-story tank, as represented by the "Imhoff Tank" in this country, there is the formation of heavy, floating scum masses which are difficult and costly to control, and which at times seriously interfere with sedimentation through entering the settling chamber by way of the slots. In addition, there is acid sludge and foaming which, when they do occur, are highly objectionable and by no means easily overcome.

Sedimentation is a mechanical process. Sludge digestion is a biological process. They are radically different. All of the foregoing objectionable features, possessed by the two types of tanks which have been described, have their origin either directly or indirectly in an attempt to combine them. When combined, ideal conditions for either one of the two processes must be sacrificed to accommodate some requirements of the other. This is explained as follows:

The highest sedimentation efficiency can be obtained only from tanks designed solely for that purpose. With the possible exception of the radial-flow type of tank, the best results in sedimentation are obtained from tanks which are long, narrow and of comparatively shallow depth. In tanks which are wide or deep it is difficult, if not impossible, to obtain an evenly distributed flow throughout the entire cross-section. Deep tanks are also subjected to disturbance caused by convection currents due to differences in temperature in the water within the tank or between the water in the tank and the incoming sewage.

Long, shallow settling compartments in two-story tanks do not lend themselves well to the design of the sludge digestion. With a long settling compartment it is frequently necessary to have a series of several compartments in the digestion chamber each with a hopper bottom. Even when careful attention is given to reversing the flow in such tanks, it is found that the digestion chambers nearest the ends become full before those nearest to the center of the tank receive their proportionate share of the sludge. If the tank is being operated to anywhere near its designed capacity it becomes necessary to withdraw sludge from the end compartments before the full digestive period has elapsed. Either this must occur or else allowance must be made when designing the tank for the dead space in the center.

Large gas vents are imperative to afford sufficient free space for floating sludge particles to discharge their burden of gas in order to sink. From twenty-five to thirty per cent of the entire surface of the tank is usually devoted to this purpose. Even this amount has frequently proven to be far from sufficient.

A sufficiently larger scum area would mean in rectangular tanks a proportionately wide digestion chamber. This condition in turn requires that either the digestion chamber must be much larger than is actually necessary, or else the depth of the tank be less than is thought advisable for the production of the best quality of sludge. In the former case, a much larger sum of money for expensive construction must be spent than would otherwise be necessary. In the latter case operating results are sacrificed.

To avoid some of the disadvantages attendant to the combined process of sedimentation and digestion, separate sludge digestion may be used. The latter consists in the use of a separate tank or a number of tanks into which fresh settled sludge is periodically pumped or drained

An old septic tank properly partitioned and baffled and with suitable piping connections can be used as a separate slude digestion tank or one can be built to a design that will meet the conditions leading to the production of sludge of suitable quality.

Briefly these conditions are:

(a) A proper proportion of sludge to water.

(b) Separation of the sludge into the two stages of digestion, namely, the fermentative or scum producing stage and the putrefactive stage in which no scum is produced.

(c) Proper proportion between acid neutralizing agents and sludge.

(d) The thorough mixing and agitation of the sludge by mechanical means.

*Part of a paper entitled "Settling Tanks and Separate Sludge Digestion" read before the New Jersey Sewage Works Association.

†Of Remington & Vosbury, consulting engineers, Camden, N. J.

(e) Regular withdrawal in small amounts.

(f) Means for drawing off the old water, or supernatent liquid and replacing with clear water.

When separate sludge digestion is used, the sedimentation tanks may be designed to meet the requirements of highest efficiency. The freshly settled sludge may be removed periodically at intervals of from one to three days. Where it is possible to locate the digestion tank so that the surface of the water therein will be from four to five feet below the surface of the settling tank, the latter may be provided with hopper bottoms and the solids drain off by gravity. When sufficient fall is not available the bottom of the sedimentation tank may be flat. The solds are then collected either by drawing off the free water from the tank and pumping the residue or by means of mechanical scrapers of which several types are now in use. The latter are used to concentrate the solids at a given point where there is usually a sump from which the sludge may be pumped to the digestion tank.

Pumps designed especially for pumping concentrated solids are now on the market. These may be employed or an ordinary gasoline engine driven, diaphragm, ditch pump can be adopted and used for the purpose.

In designing separate sludge digestion tanks the fact should be taken into consideration that it is preferable to separate the brisk decomposition of sludge which first takes place from the final stage of digestion. This coincides with the German theory that digesting sludge should not be brought into contact with sludge that has reached a more advanced state of digestion. The former, or fermentation stage, is the one in which both gas is generated and floating scum is formed in large quantities. In the final or putrefactive stage digestion is completed with the production of but very little gas or scum. Provision should also be made for introducing fresh sewage or clear water, as well as for the drawing off of stale water which constitutes the supernatent liquid. The latter should be either returned to the sedimentation tank or preferably filtered on sand beds.

Since putrefactive decomposition can take place only while sludge is alkaline, it must be kept so at all times. Daily agitation aids greatly in producing an alkaline sludge and helps to prevent both scum and foaming. Hand agitation is laborious, inefficient and is apt to be neglected. When possible, means for mechanical agitation should be provided.

Separate sludge digestion is not a new process and in view of its many apparent advantages it is deserving of more interest. While not carried on extensively in this country, there are at least two large plants, namely, at Birmingham, Ala., and Baltimore, Md., where separate sludge digestion has met with success.

At the Birmingham plant, a sludge is secured which is comparable with that from the "Imhoff Tank." It is digested in tanks of an average depth of 12.5 ft. The first or fermentative stage is over in approximately 14 days, after which the scum settles to the bottom and clear liquid rises to the top. The sludge contains 95% water, is handled without difficulty and dries without nuisance on beds within 100 ft. of residences.

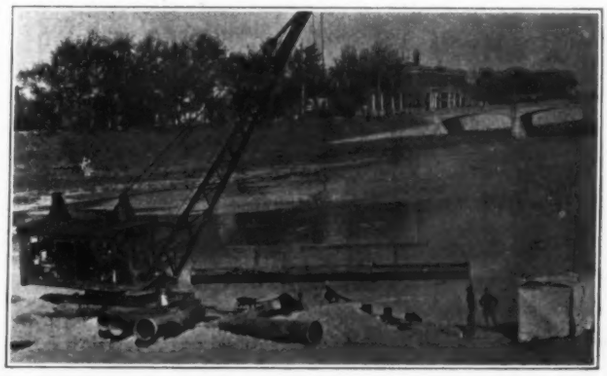
Separate sludge digestion has also been employed successfully at Baltimore for a period of over twelve years. Parallel experiments were carried on between sedimentation tanks with separate sludge digestion and "Imhoff Tanks" in which twenty-eight of the latter were used. It was found that "Imhoff Tanks" were harder to construct, cost more per million gallons of sewage treated and required more expert supervision. Trouble was experienced from both scum and foaming and it was found the hydraulic features of the tanks were poor. On the other hand, good sludge was obtained from separate sludge digestion. Great advantage was also found to exist in the complete separation of the sludge digesting compartment from the settling tank; unlimited opportunities for expansion were offered; the mechanical operation of clarification was simplified; and finally, but of no less importance, the sludge was at all times accessible and easily inspected.

Laying Sewer Siphon in Dayton

In recent construction of a siphon laid under the Miami river at Dayton, Ohio, as a part of a relief sewer in the sanitary system, the contractor adopted some interesting expedients. The siphon consists of two paralled 24-inch cast-iron pipes about 650 feet long, laid about 5 feet below the river bed, terminating in two reinforced concrete chambers constructed in the levees. The work was done by Glenn M. Wiley, a local contractor, at a cost of $11,766, the pipes, valves and fittings being furnished by the city.

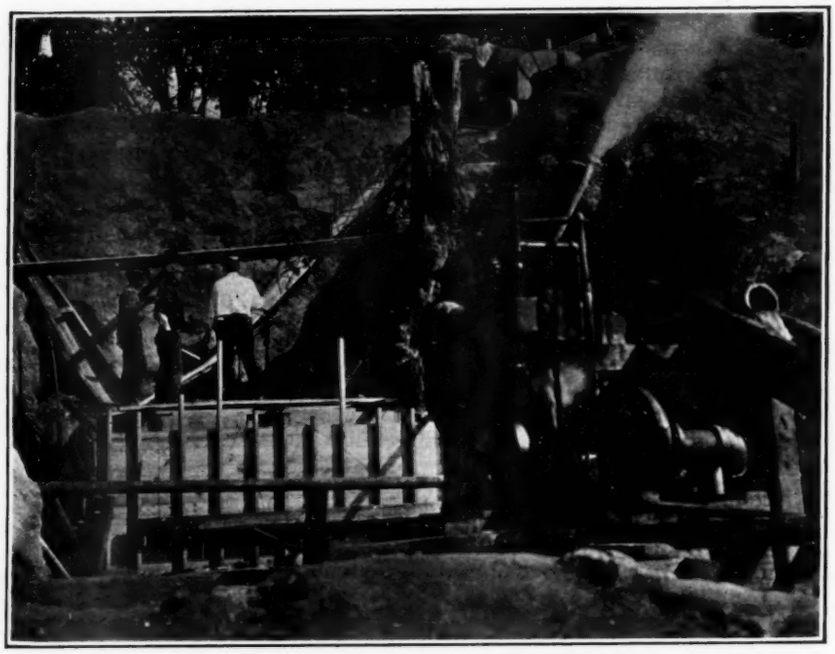
After building the siphon chambers, the trench was dug for the siphon by means of a special steam-driven drag line built by the contractor, using a 50-foot boom, a 60-horsepower boiler and a ¾-yard dragline or clamshell bucket as was most convenient.

Cofferdams were sunk for the siphon chambers and a 6-inch centrifugal pump was used to pump these out and a 1-sack mixer for mixing the concrete. In the case of the south chamber, it was necessary to go down 10 feet below water-level through clean sand and gravel, and this pump was able to



SWINGING A THREE-LENGTH SECTION OF PIPE INTO PLACE.

lower the water only about 9 feet. In order to meet this emergency, the contractor constructed a box form with a 10-ounce canvas bottom. There was about 18 inches clear space between the outside form and the cofferdam, and the pump suction was placed in this space and the water kept lowered as much as possible. With the water outside kept down and the use of the canvas bottom there were no appreciable currents rising into or passing across the form, and the concrete for the bottom was placed on top of this canvas with good results. In constructing the siphon, the cast-iron pipe was caulked under water by a diver. Three lengths of pipe were joined together and caulked above water, thus requiring the caulking by the diver of only one-third of the joints. As the water was comparatively shallow, it was possible for him to work without wearing gloves or the usual heavy lead shoes. For caulking under water a special tool was made consisting of a heavy piece of iron shaped to fit the curve of the outside of the pipe and held in place by a chain passing around the pipe and a spring which held the tool snugly in place while it was being pounded by a heavy hammer until the joint was tight. Lead wool was used for the joint material. Although this work was rather tedious, an average of three joints was completed each day.



BUILDING CONCRETE SYPHON CHAMBER.
Chuting concrete into the forms from the mixer on top of the levee, while a steam-driven centrifugal pump keeps the water down.

Millions for Sewerage and Water in Maryland

The last legislature of Maryland authorized the issuing of $18,850,000 of bonds for sewerage, water supplies and refuse disposal in that state. The largest items are $10,000,000 for sewer extensions in Baltimore City and $6,000,000 for water, sewers and drains in Baltimore County. Twenty other municipalities and districts are authorized to spend the remaining amount, 15 for water, 11 for sewer, 1 for refuse disposal and 1 for a sewage disposal plant. Abel Wolman, chief sanitary engineer of the State Health Department, says: "These issues will make possible an enormous amount of progress throughout the State in the extension and construction of water-supply systems and sewerage and drainage systems. Because of the method of financing under which the bills were passed, these health facilities have been made possible without imposing excessive burdens on individual taxpayers."

Limiting Truck Use in Cities

The operation of trucks on certain streets is restricted by ordinance in Columbus, Rochester, Cleveland, Buffalo, Indianapolis, Grand Rapids and New Orleans. Many other cities forbid them in parkways, boulevards and residence streets. In Columbus they are forbidden on two of the business streets, in Cleveland on nine business streets, Indianapolis six, New Orleans four, and Grand Rapids, one.

These restrictions on business streets are probably due almost entirely to a desire to improve traffic conditions. However, protection of pavements is another reason for excluding trucks from certain streets, or, rather, for limiting them to pavements specially designed to carry heavy loads.

It is expected that Toledo, Ohio, under its new traffic code, will take advantage of the provision of this code that it can designate "restricted thoroughfares from which heavy commercial vehicles are banned except to make deliveries."

Pennsylvania's Highway Program

The Pennsylvania Highway Department claims that its construction program for 1924 is greater than was ever attempted by an American state. It hopes to build 900 miles of durable thoroughfare and carry out a maintenance program greater than ever before. The greatest previous mileage of construction by the state was 720 miles in 1921. The resurfacing of stone roads reached its maximum of 666 miles in 1922, while the estimate for 1924 is 650 miles. Oiling of macadam roads increased to a maximum of 2,877 in 1923 and approximately 3,000 miles are on the program for this year.

Omitting the automobile division, the payroll for 1923 was $1,580,000, which was less than any year since 1919, and it is hoped that it will be little greater than that in 1924. The Automobile Division, which of course had nothing to do with construction and maintenance, had a payroll last year of $367,368 and 365 employees, nearly 100 of whom were members of the motor patrol.

Columbus Waterworks Notes

Results Obtained Last Year. Carbonating Water, Coagulation, and Parking Water Works Property

The annual report for 1923 of the Division of Water of Columbus, Ohio, C. B. Hoover, superintendent, and Charles P. Hoover, chemist in charge of water purification, as usual contains a number of points that will be found interesting by other waterworks superintendents and engineers.

The active services at the end of the year totalled 45,208, of which 44,749 were metered, giving 98.96% of the services metered, while 98.8% of the receipts for water rents were for metered water. The average amount received from metered domestic water services was $10.19, while the average received for commercial water was $216.31 per service.

During the year the hardness of the untreated water averaged 265 parts per million, while that of the water delivered to the mains averaged 95 parts. In making this reduction in hardness, 3,246 tons of soda ash and 5,594 tons of lime were required, the former costing $30.95 per ton and the latter $10.26 per ton. The costs of lime and soda ash per million gallons of water softened was $19.47.

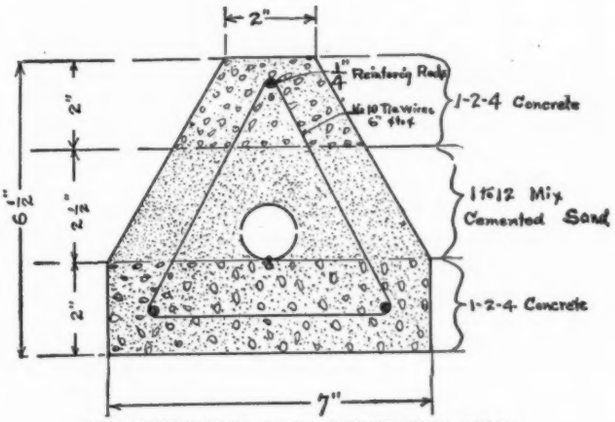
The turbidity was reduced from an average of 90 parts per million to zero, and the average color from 24 parts to 2 parts per million, the color having been reduced by the combined use of lime, soda ash and alum.

CARBONATION.

During 1922 experiments had been carried on in highly carbonating a portion of the water and mixing this with the balance of the supply, but the process was finally decided to be impracticable and the experiments discontinued. During 1923 experiments were made on the use of chimney gases from the waterworks pumping station as a source of carbon dioxide gas. These gases are drawn from the boiler through a scrubber and dryer by means of an air compressor and are forced into the water through diffusers located near the outlet of the settling basins.

Sulphur dioxide is about fifty times as soluble as carbon dioxide, so that it can be easily washed out of the gas. Carbon dioxide is about fifty times as soluble as carbon monoxide, and, when the low partial pressure of carbon monoxide in the chimney gases is taken into consideration, for all practical purposes, the carbon monoxide can be considered insoluble. Therefore, in view of the ease with which the sulphur dioxide can be removed from the gases, and further in view of the nonsolubility of the carbon monoxide, scrubbed chimney gases are sufficiently pure for the carbonation of softened water.

The type of diffuser used is shown in the accompanying sketch. It is made by surrounding a perforated pipe with cemented sand, the cemented sand being made from twelve parts of coarse screened sand and one part of cement.



CO_2 DISTRIBUTOR AT COLUMBUS, OHIO.

The base and top are made from rich concrete in order to give strength to the leaner mixture.

Experiments were carried on last year to determine the conditions relative to agitation which would give the best results in coagulation, with the following conclusions:

1. Results of plant operation and laboratory experiments indicate that velocities of 0.3 foot per second do not provide sufficient agitation for the treatment of turbid water or for water softening, but that the velocities do not need to exceed 0.6 foot per second.

2. Coagulation results obtained on turbid water at velocities of 0.6 foot per second can be obtained at lower velocities only by adding an excess amount of coagulant.

3. A short mixing period of 20 to 30 minutes at 0.6 foot per second velocities is more effective than a mixing period of 1½ hours at 0.3 foot per second velocity.

4. Mechanical agitators are less expensive to build, more compact, obviate the necessity of lifting water the extra two or three feet necessary to pass through baffled mixing tanks, and provide greater flexibility and accessibility.

PARKING WATERWORKS PROPERTY.

The banks of the river around the storage dam and extending the entire length of the reservoir, a distance of about 5 miles, have been treated as a park and called "Riverside Park." The improvements consist of building stone piers and walls at the principal entrances; two miles of drive-

ways which were surfaced with 1,700 yards of gravel taken from a pit opened on the city land; installing ten stone lampposts, 15 inches square at the base, 8 inches square at the top and 6 feet high, carrying lights and extending from the car-stop to the boat landing.

Including work done this year, there are now in service in the park twelve drilled wells, six stone comfort stations, four frame comfort stations, twenty-two stone tables, eight wooden tables, thirty wooden benches and twenty-four stone furnaces. The grass was kept cut along the reservoir throughout the Summer. Garbage left by picnickers was removed promptly, garbage cans having been provided and installed near each furnace and wood being placed near there for the convenience of picknickers. During 1922 about 2,000 young trees were planted in the park, and these were watered during the dry season and almost all are still alive, while during 1923 twelve hundred and fifty new trees were planted, also honeysuckle vines, shrubs and iris bulbs.

BACTERIAL RESULTS.

Bacterial tests were made of both raw water and that delivered to the mains every day in the year but seven. B coli was found in 0.1 CC tests 100% of the time in January, November and December, while in June only 10% of the tests were positive. In the 1 CC tests an average of 70% were positive, the minimum being 42% in April. In the water delivered to the mains, in 1 CC samples two tests for B coli were positive in January but no test in any other month. Of 10 CC tests, twelve were positive in January, one in February, two in April, one in September, three in October and one in November. These numbers are presumptive tests. In each case confirmatory tests were made and these were positive in every case except one of the presumptive tests in 10 CC in January. This certainly speaks well for presumptive tests for B coli, at least as they are conducted by Charles P. Hoover, chemist for the Columbus Division of Water.

Report on Philadelphia's Water Supply

A final report on improving and adding to the water supply of Philadelphia was submitted to the Mayor on May 23rd by a commission of seven, four of whom were engineers especially employed for the purpose, these being J. Waldo Smith, Allan Hazen, George W. Fuller and Joseph F. Hasskarl. The water of the Schuylkill river, from which and from the Delaware river are taken practically all of the supply of the city, has been increasing in pollution for some time past and is becoming difficult of purification. While the Delaware river also receives sewage from cities above, it is much more susceptible to adequate treatment. The engineers considered, therefore, their chief problem to be the finding of a substitute for the Schuylkill river supply, which would be abandoned as soon as possible. At the present time about half of the city's supply is taken from the Delaware at the Torresdale filtration plant and the other half from the Schuylkill.

The commission recommend the continuing in use of the Torresdale filters, but that about $7,000,000 be spent in improving this plant in efficiency and increasing its output from about 175,000,000 gallons per day to 240,000,000. "It is proposed to rebuild the preliminary filters or scrubbers, making them fully equivalent to the best mechanical filters, to provide new coagulating basins and appliances for treatment, and to apply, as at present, the effluent from the preliminary filters to the slow sand filters, which are in good condition and which will serve to complete the treatment. The system of double filtration, which will be made fully effective by these changes, is in successful use in a number of American cities for treating polluted river waters, and it has been for many years used in Europe. The water obtained now from the Torresdale plant is generally satisfactory and will be thoroughly so after the completion of the works herein recommended."

The present consumption of the city is about 325 million gallons per day, much of which is believed to be unnecessary waste, and the first recommendation is that meters be installed to reduce the consumption. If this be done, it is believed that fifty years hence the consumption will not have increased to more than 500 million gallons a day. It is assumed that about half of this will be produced by the Torresdale filtration plant and the remainder by new sources of supply as a substitute for the Schuylkill.

In studying several possibilities as substitutes for the Schuylkill, the engineers considered the Susquehanna river, the Mullica and Great Egg Harbor rivers in New Jersey, and the Upper Lehigh and Delaware rivers. Of these, only the two last received serious consideration, and it was believed that, although they may be utilized at some future date, the great distance and resulting cost render it desirable to use nearer supplies to their limit before going to these distant sources. Ground water was investigated, but such a supply did not appear practicable, as to either quantity or quality. The commission, therefore, decided upon utilizing to their practicable limits the Perkiomen and Tohickon creeks, which lie north and northwest of Philadelphia, the former draining into the Schuylkill and the latter into the Delaware. The catchment areas of these creeks are occupied by a rural and village population. The areas on which the reservoirs are to be built and the margins surrounding them will be acquired and owned and controlled by the city of Philadelphia. The remainder of the catchment areas and the population living on them will be under the laws and regulations of the State for preventing pollution of water supplies.

The water of Tohickon creek would be impounded by a single dam and led to one of the Perkiomen reservoirs. Perkiomen creek could be impounded by a single dam and reservoir, but this would necessitate flooding and destroying a number of villages which are believed to be of such importance that it seemed more desirable to build six smaller dams which would be almost if not fully as effective. The several reservoirs would be connected with each other by tunnels or conduits, and all the water elevated by pumping through a conduit to a filter plant to be located on ground sufficiently high to deliver the purified effluent to the city by gravity. The filtered water would pass to a new service reservoir, which would act as a balancing reservoir. At present the water pressure is undesirably low in many parts of the city, and it is proposed to bring the Perkiomen water to a new and higher distributing reservoir, from which a pressure tunnel will extend to some point in the neighborhood of City Hall, where it will deliver water to the existing distribution system under a pressure of 60 to 80 pounds, or more than double the present pressure. This reservoir and large feeder line will add considerably to the cost, but in no other way can the large additional quantity of water be delivered at suitable pressure in the business district and southern part of the city. Moreover, the cost would be less than that of increasing the capacity of the distribution system, which would be necessary during the next few years if this line were not built. It is believed also that the reduction in fire losses and insurance during a term of years will amount to much more than the cost of this feature of the plan.

The service reservoir is planned to have a capacity of 100 million gallons for the present, but to be enlarged later, adjacent land being obtained for the purpose. Meantime, several existing service reservoirs, and raw water reservoirs will supplement the storage furnished by the reservoir first constructed.

The cost of the Perkiomen-Tohickon project, including construction of dams, purchase of lands and riparian rights, pumping stations and machinery, service reservoir, filter plant and all other structures, and engineering and other overhead, is estimated at $91,500,000. The project does not lend itself advantageously to progressive construction, although it might be possible to defer certain reservoirs, filters, etc., amounting to about 16½ million dollars; but at least $75,000,000 would be required for immediate construction. If to this be added the $7,500,000 for the extension and modernization of the Torresdale filter plant and improvement of the Schuylkill filter plant (to serve for the six or eight years required to complete the Perkiomen-Tohickon project), we would have the total project costing $99,000,000. The commission, however, considers this improvement of these last as chargeable, not to new works, but rather to ordinary maintenance, repairs and replacements.

Water District for Westchester County*

Legal, Financial and Engineering Aspects of the Formation of a Water District

FORMATION OF A WATER DISTRICT

Mr. Hill devotes several pages of the report to outlining what he considers the best method for forming and operating a water district. He divides into four groups, arranged according to degree of authority, commissions which have already been created for similar purposes. These are: First, commissions or boards formed by city councils for the specific purposes of building public works within the limits of one municipality. Two, those apponted by elective officers of a city, county or state, and given resources which are limited either by specific acts or by the action of municipal, county or state authorities governing the municipalites composng the district. Three, those in charge of sanitary or water supply districts which have all of the elements of a complete municipality with power of taxation but with bonding powers depending upon referendum and with its members appointed by county or state officers or elected by the popular vote of those residing within the district. Four, similar to three but with authority to issue bonds without referendum. In addition to these four, he refers to joint commissions acting for two or more states, such as the bridge and tunnel commission now operating jointly for the states of New York and New Jersey.

Financing the work is usually done by issuing bonds or by special assessment, or occasionally by a part of the general taxes. Operating and maintenance charges, together with interest and sinking funds to retire bonds, are met from general taxation, or by special assessment, or by rates based upon service.

To obtain an adequate supply of water for Westchester County is not difficult from an engineering or financial viewpoint, but it is visionary to expect a group of communities to cooperate in such development, and the board or commission seems to be the only possible plan. This commission should have "broad powers, including the right to acquire existing water plants and sources of supply, to condemn lands and rights for additional sources, to sell water at wholesale to the communities at interest, to levy taxes and assess costs upon the communities benefited, and to issue the necessary securities to pay for the works which are required to be built. It must have complete control, not only of existing sources, but of sources which may be acquired, and be entrusted with the conservation and equitable distribution of the water which it controls among the communities served."

*Continued from page 159.

When it becomes necessary to acquire plants or parts of plants owned by private water companies, the commission should transfer the title to the municipality served by such plant and assess the municipality for its outlay thereon. "It is not proposed that the board or commission should acquire all existing sources of supply, whether municipally or privately owned, but only those which lend themselves to proper development and through the acquisition of which the general distribution of water would be facilitated. . . . It should, however, be empowered to secure any source of supply, whether publicly or privately owned, which it finds upon proper consideration is necessary to the scheme of development adopted by it. . . . The board or commission should be empowered to fix and regulate rates so that the operations of the water district would produce a revenue sufficient not only to pay the interest on the bonds and the necessary sinking fund contributions, but also operating and maintenance expenses and taxes, if any."

"The burden of cost of development would naturally be borne by those communities which took water from the beginning. Some of the communities whose present works are sufficient, might not desire to be connected with the metropolitan system until some future time when water is needed. When they did need water, however, and desired service, it would be proper that they should make equitable payment to the water district, sufficient to represent their fair proportion of the capital expended, such payments to be credited to the sinking funds and used for the retirement of outstanding bonds."

Integral Traffic Line

Reference was made in our April issue to the requirement by the Pennsylvania State Highway Department that traffic lines be built into the pavement as a part of the construction, and the uncertainty that many contractors had as to the methods and cost of such construction. These traffic lines are made 4 inches wide and are composed of one part of white cement and one and one-half parts of washed sand mixed thoroughly to a stiff consistency and having a depth of one inch in most places in the case of concrete roads. These lines are constructed in the center of the width of the pavement on curves and extend as far into the tangents as directed. The recess for the line is formed by placing a strip of 1-inch x 4-inch wood, with the edges chamfered slightly, in the correct position when the concrete is being placed; the wood being cut in segments not more than 2 feet long and attached with screws to a light metal strip along one edge so that it will conform to the curvature satisfactorily. The wood is removed from four to twelve hours after the surface of the pavement has been finished, or as soon as the workmen may stand upon the pavement without marring it; and the concrete is then thoroughly soaked with water and the white mortar placed in the recess, tamped thoroughly in place and finished with a trowel, the edges standing up boldly and slightly rounded. It is then at once protected with clean, wet canvas or burlap and cautions taken to prevent its being stained by earth or straw or other substances. Any discolorations are removed by rubbing with a carborundum block.

In bituminous surface courses the traffic line is carried the full depth of the surface course and made monolithic with the base course in the manner described above, care being taken to make it true to line and grade, the forms being cut or bent to conform to the correct curvature. In these pavements the traffic line is constructed when the base is laid and before the bituminous surface is applied. Recent bids for these lines range from 8c. to 25c. a lineal foot, this including all materials and labor.

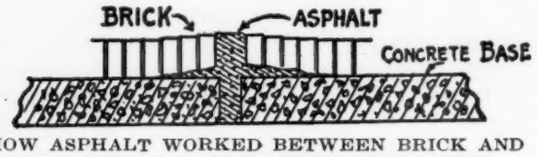
Brick Pavement Expansion Joints

Stafford County, Kansas, has recently completed a 35-mile paved road, using brick throughout, 20 miles being monolithic and 15 miles bituminous filled. Work was started about four years ago, and trouble developed the first summer with the monolithic, although the specifications were said to be rigidly followed.

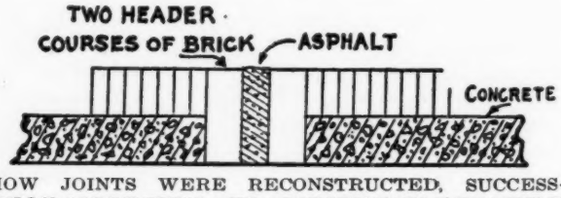
The trouble occurred at the construction joints, where the pavement buckled, three to five courses of brick on each side of the joint breaking loose from the concrete base. Following this, every construction joint was made an expansion (there had been no expansion joints before), a 2-inch asphalt joint being carried entirely through the base. But blowouts still occurred at these joints. On investigation it was found that, while the asphalt was soft on top, permitting the bricks to crowd together, it was forced between the bricks and the base, raising the latter for two or more courses back. Later, after the heat had penetrated the pavement, this asphalt softened and the brick were pushed down, the asphalt exuding.

A satisfactory solution was finally found, which is described as follows by W. A. Stacey, county engineer of Stafford County:

"In taking up the brick at these blowouts a



HOW ASPHALT WORKED BETWEEN BRICK AND CONCRETE BASE AT CONSTRUCTION JOINTS.



HOW JOINTS WERE RECONSTRUCTED, SUCCESSFULLY CORRECTING THE OBJECTIONABLE FEATURE.

joint from ten to eleven inches wide was cut clear through the concrete base. Then a header course of brick was run across each side of the joint in the base, leaving a space between the two header courses two inches wide, and this space was filled with asphalt. These header courses not only keep the hard asphalt from being pushed under the brick during expansion periods, but the lower ends of these header courses are securely locked, the hard asphalt just above the earth being between them, and the concrete base pressing against them on the other side. This method has been used on this pavement until all of the blowouts have been repaired, and now it is one of the smoothest and one of the most substantial roads in the state."

Flint's New Traffic Signal

By H. C. McClure*

A rather unusual traffic signal is being successfully used on a congested intersection in Flint, Michigan. A large amount of traffic moves over the intersection in all directions and traffic control is necessary. However, street cars occupy the center of one of the streets and the pavements are none too wide, making it practically impossible to have a police booth or other such obstruction within the intersection area.

*Consulting City Engineer of Flint, Michigan.

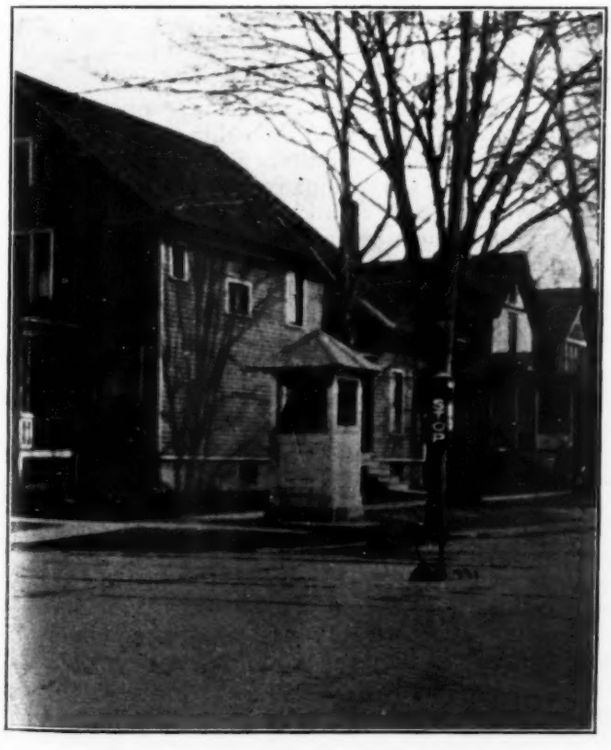
It was suggested that the police booth could be located back of the sidewalks off the streets, from which a STOP and GO signal, located in the center of the intersection, could be operated underground. This suggestion was adopted, and a similar arrangement in Battle Creek was investigated.

The details of construction of this signal, worked out by the Engineering Department, are as follows:

A compact police booth, with removable windows and equipped with an electric heater and an electric fan (donated by the local electric service company), is located over a manhole built back of the curb line on the least obstructed corner. The manhole is constructed of one length of 36-inch concrete pipe with an 8-inch tee branch. An ordinary cast iron manhole ring and cover closes the top.

From the 8-inch tee branch, an 8-inch tile line leads to a similar manhole of 20-inch tile, located in the center of the street between the street car tracks. The top of this manhole is a standard, cast-iron, electrically lighted mushroom furnished by the Elkhart Foundry Company. The handhole plate in the top of this mushroom (for changing bulbs) was drilled to take a 1¼ inch pipe shaft for the STOP and GO signal. A branch electrical connection was also inserted in the top of this mushroom.

In a corner of the police booth is a simple lever handle, mounted on a vertical shaft bearing on a steel plate in the bottom of the manhole below. This lever, which is used to revolve the street signal, can operate only 90 degrees and always points in the direction the traffic is in-



SIGNAL AND TRAFFIC OFFICER'S BOX.

ELKHART, INDIANA, TRAFFIC SIGNAL.

tended to go. Two stops are cut in the bar supporting the lever, and whenever the handle is lifted from the stops a circuit is closed, ringing a warning bell mounted outside. Near the bottom of the shaft, opposite the 8-inch tee, is keyed an ordinary bicycle sprocket wheel. A duplicate sprocket is keyed on a shaft in the street manhole carrying the STOP and GO signal. An ordinary bicycle chain is used around each sprocket, and the chains are connected with small flexible cables with turnbuckles for adjusting and tightening.

The street shaft is made up in sections. The lower section terminates about two inches below the surface of the mushroom. The upper section, carrying the signal, is machined to fit and key into the bottom section, the two operating as one continuous shaft. The upper section is wired with a flexible electric cable to plug into the mushroom fitting. This cable extends inside the shaft to a weather-proof condulet with a 40 watt bulb on top. This condulet is covered with a special STOP and GO sign of light galvanized iron, fitted with bulls eyes. The bulb is directly behind these.

This entire top portion above the mushroom is lifted out when the officer is not on duty, leaving the mushroom lighted to indicate a dangerous corner. The hole in the top is closed with a loose steel plug.

The officer on duty is better able to see approaching traffic from his elevated booth than when he was located in the street. He operates the signal merely by a quarter turn of the lever handle, while the bell automatically warns of a traffic change as he lifts the handle from its stop. The red and green bulls eyes, with the light directly back of them, are plainly visible at several blocks on a bright day. At dusk, they can be easily seen for a quarter of a mile.

The box-shaped STOP and GO sign was necessary because of the small space between street cars. It is made of light-weight galvanized iron, with a removable cover top to permit replacing the bulb if necessary. The sides are painted bright red and green, with large white letters.

As a matter of protection, the signal shaft was cut off just below the electrical connection, and a tight-fitting wood dowel used to rebuild it. It was expected that the signal would surely be run over and broken, since the police booth with the officer inside had met with that fate when he was located in the street. The traffic conditions are so much improved, however, that this has not happened after over a month's operation. If accidentally hit, the wood dowel will break and there will be no damage to any of the underground connections. The dowel and bulb can then be quickly replaced.

The signal is more than satisfactory, after a month's operation, to both the police officers and to traffic. The details of the adjustable underground connections, the automatic warning signal, the wood dowel protection, the special signal, etc., were worked out, built, and installed by the Engineering Department.

Setting Period for Concrete Base

New York City, June 2, 1924.

Dear Sir: In your issue of May 24th there is an article giving extracts from the specifications adopted by the State Highway Commission of Alabama, relating to cement "Concrete bases for black top and brick pavements." This provides for a period of setting of 21 days if the concrete is mixed with Portland cement and of 40 days if Puzzolin cement is used.

In view of the common practice of laying asphalt pavement on Portland cement 5 or 6 days old, the requirement of 21 days for Portland cement concrete seems needlessly long.

The writer has had granite pavement laid in New York City on 1-3-6 Portland cement concrete 24 hours old, and automobile traffic permitted as soon as the granite pavement was finished. Each operation, placing concrete and laying pavement, began about 8 a.m. and continued till about 5 p.m. Careful inspections of the pavement after one and two years' intense traffic have discovered no defects whatever.

The gain in tensile strength of a 1-3 Portland cement mortar at 28 days is only about 33% of the strength at seven days and can hardly be put against the inconvenience to the public, due to closing a road for an additional two weeks. Yours,

R. A. MACGREGOR,
M. Am. Soc. C. E.

Employment for Engineers

The prospects for employment of engineering graduates are not particularly bright, according to E. B. Miller, employment secretary of the American Association of Engineers. He finds that there is most demand for civil engineers, less for electrical, much less for mechanical and mining engineers. For civil engineers the greatest demand comes from highways, municipalities and large construction projects; but positions on highway work are not likely to be permanent.

Concrete Roller Patent

The Associated General Contractors of America announces that arrangement has been made with the Macon Concrete Roller Co. whereby contractors can use rollers in finishing concrete surfaces. The company claims its patent covers all such rollers and had instituted suits for royalty against a number of contractors.

Under the terms of this agreement all suits pending for past royalties against the A. G. C. members will be called off and no further suits will be undertaken. The agreement provides that in the future contractors may either purchase rollers from the Macon Concrete Roller Company or make their own rollers.

The company has agreed that the charge to be made for each roller, including the price of the roller, will be $50 per annum for the first year and $30 per annum thereafter. If the contractors make their own rollers, a tag furnished by the company at a charge of $10 must be affixed.

The simple practicality of the device, which furnishes one of the best methods yet developed for finishing concrete, opened the way for many contractors to make use of the apparatus in good faith and with no knowledge that their actions involved infringement of a patent.

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Traffic as an Engineering Problem

There can be no question not only that the traffic congestion in the streets of most of our cities is a serious problem, but also that most of the city engineers of the country realize that this is the case. In reply to a questionnaire sent out during the past few weeks to city engineers of the larger cities, an unusually large percentage not only gave information bearing upon the subject from data which they had at hand, most of which indicated that the subject had received serious consideration by them, but the great majority had given the matter sufficient thought to have formed ideas as to possible solutions.

It is true that handling traffic is a function of the police department, but after all, the police can only use to the best advantage the highway conditions as they exist, while it is the duty of the city engineer to improve these conditions and adjust them to the demands of traffic so far as his authority and the city finances will permit.

Correspondence and interviews with city engineers had already convinced us of the importance of this problem to them. Their point of view is quite fully given in the leading article in this issue. The *user* of the street may well have other points of view and other opinions as to what is desirable. The users most interested are chiefly the owners of automobiles. We expect to present in our next issue the point of view of such users as it appears to Alvan Macauley, president of the Packard Motor Car Company, who has cooperated with "PUBLIC WORKS" in obtaining the information upon which the tables and discussions in this issue have been based.

After all, the automobilists and other users of the highways are the ones who are to be satisfied, being those who largely provide the funds whereby the highways are constructed and maintained, and it is the duty of the engineer to determine what these and the other taxpayers want and to provide these wants to the fullest extent possible.

The extent to which automobile owners pay the taxes may be indicated by a few figures from the latest government reports. The official reports of population and of licenses issued to private passenger cars by the several states in 1923 show that the number of citizens per private passenger car in several of the states were very approximately as follows: California, 4 persons per car; Iowa, 4½; Kansas, 5¼; Indiana, 6; Ohio, 6½; Illinois, 8; Massachusetts, New Jersey and Pennsylvania, 10; New York, 11. As the average size family is slightly less than five, these figures appear to indicate that in California and Iowa there is an average of more than one car to each family in the state, while even in New York, the tenth state in the list, there are only 2½ families to a car. These refer to private passenger cars only and do not include trucks or commercial cars. If we consider that probably the owners of cars pay larger taxes per capita than those who are not owners, and that business houses owning trucks pay a considerable part of the taxes, it will be apparent how large a percentage of the taxes are paid by automobile owners and, therefore, to what a very high degree the wishes of such owners should be consulted in the expenditure of taxes for constructing, reconstructing and maintaining streets and highways.

Eliminate Irresponsible Contractors

Everybody seems to agree that the irresponsible contractor is a nuisance and should be eliminated—except perhaps the irresponsible contractor himself. He would probably eliminate himself through the bankruptcy courts if he were not of that class of which one is born every minute.

Responsible contractors detest him because his out-

standing characteristic is bidding for work at less than the cost of doing it honestly and well. Engineers despise him because his low bids require them to either give him the contract and suffer delays, lawsuits and constant bickering, or give it to a higher and responsible bidder and be accused of graft by the taxpayers. The surety companies are beginning to realize that they can not continue to pass on to the shoulders of the other contractors (and by them to the tax payers) the financial losses caused by their underwriting any contractor regardless of his responsibility.

And it looks as though this pest would soon be suppressed. The latest move in this direction was a meeting, on June 6th, in Washington, D. C., of contractors, highway officials and representatives of surety companies, with Secretary Hoover, to discuss the matter. The Associated General Contractors were responsible for the conference.

The conference passed a resolution favoring the elimination of the bid bond on contracts and the sureties' consent; also another, that each contractor should furnish full and accurate information, at the time of making application for surety bonds, as to his financial standing, experience and contingent liability from work on hand, none of this information to be more than six months old. In this connection, experience was considered the most important factor, the amount and condition of his equipment next, and his financial condition third.

Another meeting of these representatives is to be held in September when committees will report on methods of obtaining credit information, on objectionable practices of surety companies and their agents, and on uniform enforcement of the time penalty and other points.

It appears that the surety companies are looked to by the engineers and contractors for supplying the eliminating motive, and the fact that seven such companies were represented at the conference would seem to promise well. But the engineers and contractors can aid considerably, and it is to be hoped there will be united action by all to bring about this improvement.

Wear of Concrete Pavements

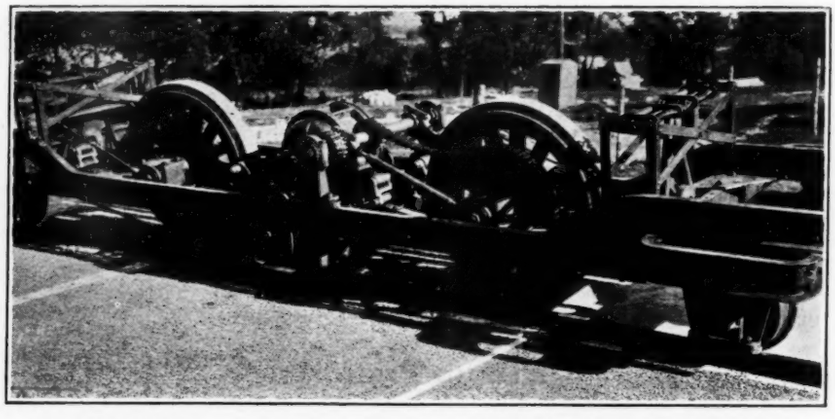
Conclusions drawn from tests of sixty-two sections made by the Bureau of Public Roads. Gravel aggregate wears as well as stone, or better; siliceous preferable to calcareous. Shale is objectionable. Well graded slag satisfactory. Sand preferable to screenings for fine aggregate. A 1:2 mixture of sand and cement most durable.

We have previously described a test being conducted by the Bureau of Public Roads, at Arlington, Va., on concrete pavements, 62 test sections being laid as parts of a circle of about 625 feet circumference; the several sections differing from each other in certain features, such as mix, consistency, nature of aggregate, etc.

THE PURPOSE AND RESULTS OF THE TEST

The primary object of the test was to determine what relations, if any, exist between the surface behavior of concrete roads under traffic and the various laboratory tests for quality of the aggregates. Incidentally, it was also deemed desirable to determine the relation between the wear as produced by traffic, as well as by laboratory test, and the various physical properties of the concrete, such as crushing strength, transverse strength, modulus of elasticity and absorption. All of these tests were made on the concrete used in each of the 62 test sections.

The sections have been subjected to approximately 300,000 passages of a solid-rubber-tired truck wheel loaded to 3,000 pounds, traveling over the same path at a speed of 22 miles an hour. A considerable percentage of the runs were made with a wheel equipped with chains.



TRUCK-WHEEL APPARATUS USED IN TESTING PAVEMENT WEAR.

The results of the test have been determined and recorded in too great detail for publication here. The conclusions from the tests, as stated by the Bureau, are as follows:

CONCLUSIONS

Before attempting to draw general conclusions from these tests, it may be well to restate certain premises regarding the volume and character of traffic to which the test pavement has been subjected. These premises follow:

1. That on the average 18-foot concrete road, approximately 10 per cent of the total traffic moving in both directions passes over a band 6 inches in width at the point of maximum concentration.

Therefore, the traffic passing over the test road should be multiplied by at least 10 to obtain the equivalent volume of traffic on an actual pavement.

2. That the comparative resistance of each test section to the surface wear produced by the tire chains is an indication of the comparative resistance which would be offered by the concrete to wear or disintegration at the edges of exposed joints and cracks under service conditions.

3. That conditions which cause surface wear, such as steel tires, tire chains tracking through snow, etc., are present to such an extent as to make it necessary to give the question of wear consideration in the selection of concrete aggregates.

The authors believe that the data so far secured warrant the following conclusions:

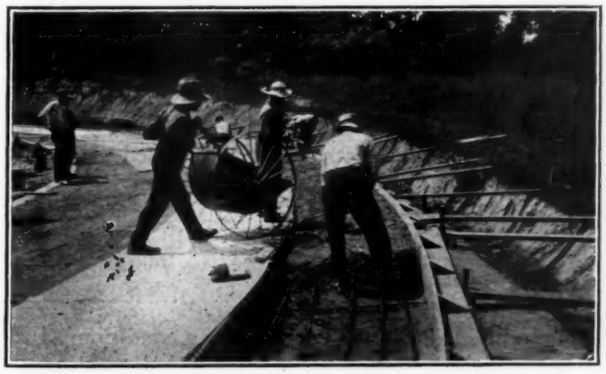
1. That the rate of wear of stone concrete is, in general, not affected by the coarse aggregate, provided the coarse aggregate is equal to or superior to the mortar matrix in resistance to wear.

2. That excessive wear will result from the use of very soft stone as coarse aggregate even though used in conjunction with a mortar of satisfactory quality. From the results of these comparative tests, it would appear that stone with a percentage of wear over 7 should not be used in concrete road construction.

3. That gravel concrete, in general, is at least as satisfactory from the standpoint of wear as stone concrete.

4. That gravels consisting essentially of siliceous materials are superior as regards both the amount and uniformity of wear to those containing a preponderance of calcareous fragments.

5. That gravels consisting of rounded particles are as satisfactory from the standpoint of wear as those consisting either wholly or in part of angular or crushed fragments.



DEPOSITING CONCRETE IN REINFORCED SECTION OF TEST PAVEMENT.

FINISHING SURFACE OF A TEST SECTION.

6. That small amounts of shale occurring in the coarse aggregate will cause both excessive and uneven wear.

7. That the modified abrasion test for gravel in its present form is not an indication of the wear-resisting properties of coarse aggregates. It is suggested that if the severe impact action of the steel balls were decreased, much more indicative results would be secured.

8. That blast furnace slags should prove satisfactory for use in concrete pavements provided the proportion of light, porous slag is so controlled that the weight per cubic foot will be at least 70 pounds.

9. That the presence of large amounts of light, porous fragments in blast furnace slag will cause excessive wear.

10. That somewhat better results are secured by the use of the smaller sizes of slag.

11. That slag or stone screenings are, in general, unsatisfactory as substitutes for natural sand as fine aggregates in concrete road construction.

12. That the copper and lead smelter slags used in these tests would make satisfactory aggregates for concrete road construction from the standpoint of wear.

13. That coarse sands, other things being equal, show greater resistance to wear than fine sands.

14. That the so-called "tensile-strength-ratio" test is no indication of the wear-resisting properties of concrete made with these sands.

15. That the Talbot-Jones wear test is not, in general, an indication of the wear which takes place under traffic.

16. That neither the crushing nor the transverse strength of concrete is a measure of its wear-resisting properties.

17. That the addition of hydrated lime in the proportion used in these tests does not affect the wear-resisting properties of concrete.

18. That so far as resistance to wear alone is concerned, increasing the cement content beyond a cement-sand ratio of 1:2 does not materially affect the concrete. Leaner mixes on the other hand show marked increase in wear.

19. That unusual precautions should be taken in using mine chats or other similar harsh-working materials, so as to increase workability to a maximum and thus make possible a smoother surface finish.

20. That, other things being equal, either an excessively dry or an excessively wet mix will show less resistance to wear than concrete of medium consistency.

Outstanding from these conclusions are two facts of major importance. These are:

1. That rubber-tired traffic alone does not appreciably abrade the surface of a concrete pavement.

2. That there is no consistent relation between the results of the "tensile-strength-ratio" test for sand,

the compression or transverse strength tests or the Talbot-Jones wear test of concrete, and the wear-resisting properties of concrete pavements.

Motor Vehicle Tags in Pennsylvania

The Department of Highways of Pennsylvania has this year issued considerably more than 1,000,000 motor vehicle tags, the millionth plate having been issued on August 1st, on which day alone more than 1,000 passenger vehicle plates were issued, this being the date at which the registration rate was reduced to one-half for the balance of the season.

Of the first million vehicle tags, 890,283 were for passenger vehicles, 69,104 for commercial vehicles, 3,244 for tractors, 1,287 for trailers, 17,474 for motorcycles and 18,068 for motor vehicle dealers.

Cost of Convict Road Work

By E. M. Wheeler, Superintendent

The road system of Jefferson County (Alabama) was fully described in PUBLIC WORKS, April 29 and May 6, 1922, and the methods of road maintenance, and the handling and costs of convict labor were given in detail. In general, the same methods are now used, but new trucks and equipment have been added, and convict labor is now used exclusively, except for such skilled labor as may be needed to operate the machinery.

With the heavy traffic that the roads are called upon to bear, maintenance is a problem, with the cheaper types. It has been proved pretty conclusively in the past two or three years that a permanent pavement, properly maintained, is cheaper for such conditions as obtain in most of the main roads in Jefferson County, than a chert, gravel, slag, ash, or natural soil road, all things being considered. At present there are under maintenance by the county, 1,415 miles of these temporary types of roads. This work is handled from seven convict camps scattered throughout the county. In these camps are 296 convicts, who are equipped with 70 mules, 34 motor trucks and 16 tractors.

The cost of maintaining the convict camps for the year 1923 is as follows:

Groceries	$31,947.69
Clothing	9,168.49
Camp maintenance	22,738.22
Guard payroll	36,219.41
General Expense	26,178.61
	$126,252.42
Groceries for free labor	8,046.14
Convict maintenance	$118,206.28
Convict work days	60,228
Convict idle and yard days	28,042
Free labor feed days	29,742
Total feed days	118,012
Average cost per day for food	$0.27
Average cost per day for work	1.96
Average cost of mules per day	.50
Number of mule work days	20,641
Number of mule feed days	29,449

These costs varied, of course, in the different camps, depending on many items, such as length of haul of material and food, number of prisoners at each camp, etc. The average food cost per convict per day varied at the seven camps from 24 cents at the camp having the largest number of prisoners to 36 cents for the camp having the fewest prisoners. Likewise, the cost of getting a full day's work out of the convict, which averaged $1.96 for all prisoners, varied from $1.79 to $2.75 per day, depending mainly on the size of the camp. The mule costs varied from 42 cents to 56 cents per day, and the mules worked almost exactly 70 per cent of the time, making the average cost of mule maintenance slightly over 70 cents per work day.

The largest camp contained about 80 prisoners; the smallest camp had 20 prisoners or less. A scarcity of prisoners in the last four months of the year cut down the available labor without reducing overhead, and raised costs in all branches. It should be remembered, also, that all convicts, whether sick or well, able-bodied or disabled, must be accepted and cared for. The percentage of work days to feed days was just under 70 per cent; a very fair average.

There were on hand at the beginning of 1923, 248 prisoners; 448 were received during the year; 20 were recaptured. Discharges during the year were 444; deaths, 2, and escapes, 52. There were on hand at the end of the year 218 prisoners.

Costs of operation for the trucks used on this work are shown in accompanying tables for the periods from January 1 to June 30, and from July 1 to December 30. It will be noted that, at a cost per mile of about 13½ cents, 173,975 tons of material were hauled.

Despite the difficulties and costs, the roads have been maintained in a very satisfactory condition. In fact, throughout Alabama and the South generally the roads of Jefferson County are famous. Because of the mileage to be maintained and the traffic that these roads carry, this work has been difficult and expensive; nevertheless, the citizens are getting returns for their money, and are satisfied with the general condition of the roads.

REPORT OF TRUCKS OF JEFFERSON COUNTY

For the Six Months Ending June 30, 1923

Trucks No.	Trucks Tons Capacity	Total Mileage	Work days	Average miles per day	Cost of oil and gas	Drivers	Repairs	Total Cost	Mile—Tons	Total Tons	Cost per Ton—Mile
11	2	73,560	1,415	52	$4,931.14	$5,135.50	$3,862.67	$13,929.51	73,713	17,964	$0.189
3	2½	17,465	325	54	1,253.98	1,170.00	2,159.93	4,583.91	18,591	4,404	.246
19	3½	119,852	2,129	56	8,582.97	7,874.00	9,707.27	26,168.25	203,461	56,107	.129
					For the Six Months Ending December 31, 1923						
2	2	10,960	262	42	610.39	1,230.10	1,019.46	2,859.95	9,010	2,239	.317
32	3½	248,525	4,226	59	12,611.59	18,846.22	18,088.50	49,546.31	416,418	93,263	.119

American Waterworks Convention

The Forty-Fourth Annual Convention of the American Water Works Association. Changes in the Constitution and Other Important Business. Papers and Reports of Committees, and Discussions of these and of Questions from the Question Box

There is general agreement that the forty-fourth annual convention of the American Waterworks Association, held in New York City, May 19th to 23rd, was as successful from every point of view as any convention ever held by this society, if not the most successful. The audience hall was well located with less annoyance from noises than is so often experienced, and was well filled with interested engineers, superintendents and others interested in waterworks matters at almost all of the sessions. The program was carried through practically as arranged and such time as was available was fully occupied with profitable discussions. The exhibits were fully up to past standards and were well and attractively arranged and convenient to the assembly hall, but separated from it by a hallway which served as a sound-deadener. There were registered with the secretary about 575 active members and about 225 associate members.

Important steps were taken by the Association looking to increased importance and broadened activities within the near future. Perhaps the most notable of these was the formation of two new divisions known as the Fire Protection Division and the Plant Managers and Operators Division, presumably to be conducted along the lines which have been followed by the Chemical and Bacteriological Division of this society, such as the holding of separate sessions during the convention and the election of its own officers. The officers chosen for the first year of the Fire Prevention Division were as follows: Chairman, Nicholas S. Hill, Jr., consulting engineer, of New York City; Vice-chairman, Allan W. Cuddeback, engineer and superintendent of the Passaic Water Company; secretary-treasurer, Clarence Goldsmith, engineer of the National Board of Fire Underwriters.

Papers were so selected and the program so arranged as to group together papers on fire protection and related subjects with the effect of producing a special session of the Fire Protection Division even before that division was organized. Similarly there were brought together papers on standards for drinking water which formed the basis for an active discussion on this subject. The superintendents' session brought out some very interesting papers, but as usual the time devoted to the question box was not as long as indicated by the program. In fact, little time was available for the questions until the final afternoon session, by which time a large part of the delegates had left or were preparing to leave and comparatively few were present, but these few were rewarded by most interesting discussions.

Monday was devoted to the meeting of the Executive Committee and standing and special committees. At 6:30 o'clock, however, there was a very important event—the testimonial dinner in honor of J. M. Diven, who retired as secretary after twenty-two years of service. On this occasion the society presented Mr. Diven with a substantial financial recognition of the value of his services. A new section of the constitution that was adopted on the following day made him secretary emeritus, assigning as one of his chief duties that of continuing the growth in membership of the society which had made such headway during the recent years of his secretaryship.

The officers chosen for the coming year were as follows: President, Frank C. Jordan; vice-president, Harry F. Huy; treasurer, William W. Brush, and director, J. Arthur Jensen. The place chosen for the 1925 convention was Louisville, Ky., on the second ballot, Louisville and Atlanta receiving the two highest votes on the first ballot.

Important changes in the constitution recommended by the Executive Committee were adopted. Some of these changes were: Creating three new districts, making nine districts and nine trustees; changing the method of choosing the convention city, such choice in the future to be made by the Executive Committee on recommendation by the Convention Committee. (This was the only amendment not carried practically unanimously.) The authorization of two new divisions to be known as Fire Prevention and Plant Managers and Operators. To prevent confusion, the name, "National Section," was substituted for "National Division" previously used for designating groups of members in sub-organizations in different sections of the country. Financial allowances to sections and divisions were made just double what they have been. The fiscal year of the Association was changed from April 1st to January 1st. The position of secretary emeritus was created for Mr. Diven, who retires as active secretary.

H. B. Keeler, John M. Diven and Clemens Herschel were elected Honorary Members of the society.

TUESDAY'S SESSIONS

The convention proper opened on Tuesday morning with the announcement of the officers elected for the year 1924-25. The Executive Committee then reported, the principal features

of the report being its recommendation of certain changes in the constitution. These amendments were all adopted without change.

Various committees then reported. The Committee on Electrolysis, which had been cooperating with similar committees from other societies, was continued and its work approved. A fund is being raised for the work done by this joint committee, and while the American Waterworks Association did not contribute as a body, several of its members had and the fund now contains about $13,000.

In the matter of standard form of contract, of which committee John M. Goodell was secretary, he stated that at a joint conference held by representatives from several societies minor suggestions as to modifications of the form previously presented were made and all of the recommendations of the American Waterworks Association had been adopted. This form has not yet been printed but probably will be shortly. This committee also was continued.

The report of the Standardization Council was presented by President Fuller in abstract, having previously been printed in the Proceedings.

The papers and discussions were then taken up, beginning with a paper by L. P. Wood entitled, "Allocation of Water Supply Derived from Watersheds of Interstate Streams," which was followed by a written discussion by Morris Knowles in which he referred to stream regulation for the Pittsburgh district, the State of Pennsylvania and the United States War Department cooperating. Further discussions were given orally by A. W. Cuddeback, N. S. Hill, T. H. Wiggin, (who cited the case of the North Platte river which flows through three states), L. L. Tribus, J. M. Goodell, (who referred to Arkansas river litigation) and William Gore.

Information concerning and a defense of iodine treatment of the Rochester water supply was then read by Beekman C. Little, who stated that it cost the city about $3,000 a year, or 1c. per capita, to supply this treatment, which he did not think could be considered extravagant even if it were admitted that the results were doubtful. George W. Goler, health officer of Rochester, presented a written discussion favoring the practice. Messrs. Ellms, Hinman and Prof. Whipple were opposed to the practice as being of doubtful practical value, while Mayo Tolman commended Rochester for trying out the idea. Scotland G. Highland in this connection stated that in West Virginia an investigation by the Health Department had shown that 50% of the schoolgirls have goitre to a greater or less extent. Dr. Max Levine stated that where iodine is prescribed by physicians for goitre they give up to 100 drops a day in milk and that he questioned whether the minute doses given in water by Rochester would have any effect. Others also spoke questioning the value of the treatment and suggesting that water consumers object to having so many kinds of chemicals placed in their drinking water.

In the afternoon there was held what was practically a fire prevention session, introduced as such by President Fuller, who asked that a special chairman be chosen for the meeting, Mr. Jordan being selected for that position. George W. Booth described the method and appliance employed by the Fire Underwriters' engineers for making flow tests from hydrants. The appliance is an application of the pitot tube. In making the test, four hydrants are usually tested at a time, with flow from one steamer nozzle or two hose nozzles at each hydrant.

"The Relation of Fire Protection Requirements to the Distribution System of Small Towns" was the subject of a paper by Clarence Goldsmith, who gave some practical points on the designing of water distribution systems to secure the best fire protection. Franklin H. Wentworth, secretary of the National Fire Protection Association, discussed "The Economic Significance of the Fire Waste." Following this, the new Division of Fire Protection was organized, with the officers already named. V. B. Siems then read his paper on "Fire Flow to Be Provided in Large Cities Under Various Conditions of Risk," which was discussed by Messrs. Wolman, Howland, Booth and Brush. Many practical points and practices were brought out, one being that in Baltimore two valve crews are always in service testing valves to see that they are in good operating condition and open. Instances were cited where one or more very important valves had been found closed, which greatly reduced the fire-fighting pressure in the distribution system.

Following the papers, an effort was made to act upon district nominations of members to the Nominating Committee, but as delegates representing several of the districts had not yet met and agreed upon the nominees, the matter was postponed until Wednesday morning. However, Stephen H. Taylor was selected for the New England states, or District No. 2, Frederick E. Beck for New York State—District No. 3 and V. Bernard Siems of Baltimore for District No. 5.

Meantime the Chemical and Bacteriological Section had been holding a session, at which Jack J. Hinman, Jr. gave a progress report as chairman of the Committee on Standard Methods of Water Analysis. Following a discussion of this, a paper was presented by M. C. Whipple describing "A Defect in Permanent Color Standards Due to Variations in Cobalt Chloride"; two by A. M. Buswell—"Color Transmittency Curve of Some of the Colorimetric Standards Including Cobalt Chlorides," and "Micro Dissolved Oxygen Apparatus." Max Levine presented some notes on the use of dyes in agar media, Jack J. Hinman described "Use of Gentian Violet Broth," C. S. Linton presented "A Note on the Voges Proskauer Reaction," and William Rudolfs described "The Organization and Program of Sewage Investigations of the New Jersey Agricultural Experiment Station and the State Department of Health."

Tuesday evening was devoted to a program by the Waterworks Manufacturers Association, with John F. Regan, president of that association, in the chair. Allan Johnstone read a paper

on "What Water Really Is," which was illustrated with lantern slides. W. L. Egy, of W. & L. E. Gurley, described "The Development and Manufacture of Engineering and Surveying Instruments."

WEDNESDAY'S SESSIONS

On Wednesday morning the remaining nominations for the Nominating Committee were made, C. D. Brown for District No. 1, Geo. C. Gensheimer for District No. 4, John W. Toyne for District No. 6, L. B. Mangun for District No. 7, H. E. Keeler for District No. 8 and W. W. Hurlbut for District No. 9.

As three new districts had been created by the constitution just adopted, it was necessary to elect three trustees and those selected were Alexander Milne for District No. 1 or Canada, J. E. Gibson for District No. 5 or the southeastern section of the country and F. M. Randlett for District No. 9 or the Pacific Coast and all points outside of the United States and Canada.

S. T. Powell, chairman of Committee No. 11, presented a report on "Sanitary Fountains," recommending the adoption of the Iowa Section's report of 1919. After this paper the President introduced C. M. Avery, chairman of the Texas Waterworks Association, who addressed the Association briefly and the hope was expressed by both him and the President of the A.W.W.A. that the Texas Association might join the national body.

A paper by Allen W. Freeman entitled, "Standards for Satisfactory Drinking Water," was then read by Abel Wolman. Although this paper was given as a committee report on the new U. S. Public Health Service Standards, attention was called to the fact that the most important points brought up in the paper were not contained in the new standards at all but were original with Mr. Freeman, and that the report had not been submitted to the other members of the committee. Considerable discussion followed the paper and a great deal of opposition to the points introduced by Mr. Freeman, many of the speakers apparently being under the impression that the points objected to were contained in the U. S. Public Health Service Standard. Dr. McLaughlin, chairman of Secretary Mellon's Committee, explained that the standard was proposed, not to be used as a coercive method, but as educational only. The matter was treated from another point of view by Prof. Geo. C. Whipple in a paper "Government Requirements and Professional Standards." The discussion was entered into by Messrs. Wells, Jordan, Hale, Hinman, Ellms, Bartow, Howard and others. Among the opinions expressed were: one by Mr. Jordan that the standard proposed was too high for general adoption; by Mr. Hale, that 0.2 parts per million allowable for lead and copper were altogether too high; Mr. Hinman called attention to the fact that there is another United States Standard, that of the Department of Agriculture; Mr. Ellms suggested that, while the United States Public Health Service may not use their standard coercively, courts in deciding upon waterworks cases might interpret them quite rigidly. Mr. Gore emphasized the desirability of tests for immediate result rather than waiting many days for the same. After two or three had expressed a decided opinion for a practicable minimum standard rigidly enforced, Dr. McLaughlin again expressed his preference for educational rather than police activities and stated that details had intentionally been omitted from the government regulations as they were not intended as legal directions which must not be violated but as pointing the way towards the general end aimed at.

On Wednesday afternoon Dabney H. Maury read a paper entitled, "Large Water Supply Mains," in which he compared cast-iron, steel, reinforced-concrete and wood stave pipe, the comparison including not only characteristics but also cost. This was followed by a general discussion on water pipes. Edgar S. Ritchie of Melbourne, Australia, who was attending his first convention of the Society, stated that 6½ miles of wrought-iron pipe in that country, after thirty-five years of service, had been taken up, cleaned and coated and relaid, which was considered advantageous and economical. Mr. Gore stated that even large steel pipe may lose capacity through corrosion, the Coolgardie line 360 miles long having lost much of its capacity. W. W. Brush did not consider that the coating at present used on cast-iron was at all satisfactory, and believed that cement would be found preferable. In New York City they had found bitumastic far superior to dipped coating. He referred to a line of steel pipe in New York twenty-eight years old which is still in good condition. Col. Wood stated that steel pipe in the Catskill Aqueduct 8 to 11 feet diameter had all been lined and covered on the outside with cement and wherever there had been occasion to reach and inspect the steel pipe, it had been found in perfect condition. For coatings several materials had been tested by the city, but bitumastic enamel had been found best and had been used for submarine steel pipe. Mr. Leisen, chairman of the Committee on Steel Pipe Lines, stated that agreement upon a standard specification for steel pipe was being held up because it seemed impossible to find a coating satisfactory to the committee.

Following this somewhat lengthy discussion, a superintendents' session was opened with the organization of the Plant Managers and Operators Division with W. S. Cramer as chairman and J. M. Diven as secretary. Mr. Leisen described how he had cleaned the sedimentation basins at Omaha by flushing them out without drawing off the water by simply opening flush-out openings in the bottom of the basin. The turbidity at times reached 30,000 parts per million and the first sedimentation basin filled up so as to require flushing in from 24 to 48 hours. This plan had saved the city $15,000 to $18,000.

During the afternoon the Chemical and Bacteriological Section had listened to a report of Paul Hansen, chairman, on "Filter Sand Testing and Recording," and one by Edward E. Wall on "Practical Loadings for Purification Proc-

esses." Personal experiences were then contributed to a general discussion by Messrs. Armstrong, Baylis, Green, Henderson, Hoover, Jordan and others. In the evening the Chemical and Bacteriological Division had a dinner at which Mr. Fuller suggested changing the name to Water Purification and Control Division. A considerable number of members of the division were called upon to speak during the dinner.

(To be continued)

BIRD'S-EYE VIEW OF ROAD-MACHINERY

North Carolina's Road-building Demonstration

Prominent South American engineers and ambassadors inspect roads and road construction methods, under the escort of North Carolina officials and accompanied by scores of highway officials from many other states.

For about a week beginning June 4th, North Carolina, through its highway department, gave a demonstration of road building and maintenance and otherwise entertained about forty visitors from South and Central American countries and hundreds from many states of this country, in addition to about 3,000 citizens of North Carolina who joined the party for two or three of the festival occasions. This demonstration had been under preparation for several months, as has already been stated in "PUBLIC WORKS."

The delegates from the Spanish-American states included ambassadors and minsters from Brazil, Ecuador, Panama and Salvador. More important for the actual results expected in South American road construction were the engineers, of which there were three from Argentina, two from Bolivia, three from Brazil, three from Chile, three from Colombia, two from Cuba, one each from Costa Rica, Ecuador, Guatemala, Honduras, Nicaragua, Panama, Paraguay, Peru, Salvador and Santo Domingo, and two each from Uruguay, Venezuela and Mexico. Altogether the official party comprised about 200, traveling through the state in a caravan that aroused interest all along the route.

The large number of visitors concentrating at Greensboro and vicinity not only crowded the hotels to capacity but also necessitated opening college dormitories and other buildings for housing and feeding them.

Most of the South American visitors reached this country at New York and proceeded to North Carolina, where the tour began at Raleigh on Wednesday and ended at Ashville on the following Tuesday, so far as this special caravan inspection is concerned. The Pan American Commission, however, continued their investigation of American highways in states west and north of North Carolina.

The party made a tour over several hundred miles of the roads of the state, the itinerary carrying them from Raleigh through Durham, Hillsboro, Burlington, Greensboro, Yanceyville, Winston-Salem, High Point, Salisbury, Charlotte, Gastonia, Ashville, Sylva and many other intermediate cities and towns. On this route they were able to inspect practically every type of pavement used on highways in the United States, including asphaltic concrete on concrete base, plain concrete, Kentucky rock asphalt, plain and bituminous macadam, sand clay, topsoil and dirt roads, together with sheet asphalt and other types of city pavement in the cities passed through.

At Greensboro there was an exhibit of road machinery that had been gathered together by 101 manufacturers and distributors and which had been brought in more than sixty freight cars to the fair grounds where it was displayed. Part of the machinery used for earth-handling and other road work was given a demonstration at the fair grounds. In addition to this, most of the types and many makes of each type were seen in actual operation in road construction at various points along the route, where the construction details were explained to them by state engineer Charles M. Upham and his assistants, whose statements were interpreted in Spanish for the benefit of the visitors.

Interspersed with the inspection of roads and acquiring of technical information was a great deal of entertainment—speeches by state and city officials, barbecue dinners and other feasts, a negro music festival, special church and musical services on Sunday, and minor forms of entertainment at various points.

That the South American engineers were in earnest in their desire to learn what North Carolina could teach them concerning road-building was evident, and the local reporters especially seemed to be greatly impressed by the universal and almost continuous use of notebook and pencil by these delegates. This inspection under the escort of United States engineers and the demonstration of modern road machinery made by United States manufacturers cannot help but have given valuable information to these visitors from countries where highway construction is about at the point where it was in this country a generation ago. In addition to this, it is probable that manufacturers whose machinery was inspected by them will profit by future orders from many of these countries; while the pleasant intercourse between the foreign engineers and those of the United States will certainly help to promote Pan American friendship and amity.

EXHIBIT AT GREENSBORO, N. C.

BARBECUE AT YANCEYVILLE.

Street Traffic and City Planning

To what extent the enormous development of city traffic has made imperative street widening and other changes in structure and improvements in handling traffic, and suggestions for meeting the problems, as reported to Public Works by two hundred and fifty city engineers.

In the three tables on the following pages we have endeavored to present in condensed form facts and figures as to street widths and widening and city planning done and contemplated in about two hundred and fifty cities; while in the first article in this issue are given various suggestions for eliminating or improving the objectionable conditions offered by about two hundred city engineers. Two other articles summarize the information given in the tables.

The answers from which the tables have been compiled were given in reply to the following questions:

Total mileage of streets within city limits.

Average width, between property lines, of main thoroughfares, business streets, and residence streets.

Has your city a city planning commission, or any body with city planning functions?

Has your city ever had a comprehensive city plan prepared? When? Has any part of it been carried out? If so, what?

Is there any official plan for the future street layout of any part of your city?

Have traffic counts been used in your street planning? Have any special studies been made of traffic conditions in your city?

Have any of your streets been widened because of increasing traffiic? What has been the total cost of such widening?

Is there any street widening now under construction? What is the total estimated cost? Are any such projects proposed, and at what cost?

In addition to these condensed statements, several of the city engineers have described work done or being done by their cities in widening streets. Such a description of Wilkinsburg, Penn., improvements, written by Charles F. Sperling, borough engineers, is published in this issue, while in a future one Dudley C. Meyers, commissioner of public works of Oak Park, Ill., will describe street widening in that village (two photographs of Oak Park streets are shown on pages 178 and 179), and W. L. Dunn, City Engineer of Uniontown, Penn., will give some details of street widening in that city.

The cities from which replies have been received comprise those of all sizes from ten thousand up to Chicago and New York, and from all sections of the country from Maine to Washington, from Georgia to California, and from Michigan to Texas, only four states failing to be represented.

In tabulating the replies, cities that gave only negative replies to all the questions in any one table were omitted from that table. Thus, quite a number of cities reporting no street widening done or definitely proposed are not mentioned in the table headed "Street Widening." Which ones these are can be learned by comparing this table with that headed "City Streets," which contains all the cities reporting up to the time the tables were compiled.

CITY STREETS

City	Total miles within city limits	Average width between property lines: Main thoroughfares	Business	Residence
Alabama:				
Anniston	40	80	100	60
Birmingham	800	60	80	60
Montgomery	127	100	80	60
Arkansas:				
Fort Smith	..	50 to 120	50 to 120	50
Texarkana	60	80	80	80, 60 & 50
California:				
Bakersfield	100	115.5	82.5	82.5 & 60
Berkeley	200	60 to 180	80	60
Glendale	170	80 to 110	60 to 110	40 to 60
Los Angeles	3,543	80 to 100	90	50 & 60
Pasadena	212	70	70	55
Richmond	194	80 to 100	60 to 80	50
Riverside	275	100	100	60
Santa Ana	140	60	60	50
Santa Monica	125	80	80	80
Stockton	168	60.6 & 80.8	60.6 to 111	50 to 80.8
Vallejo	60	100	80	80
Colorado:				
Boulder	90	80	80	60
Colo. Springs	143	140 & 100	140 & 100	140, 100 & 60
Denver	900	80	80	60
Pueblo	240	80	80	66, 70 & 80
Connecticut:				
Ansonia	30	38	38	27 to 32
Bridgeport	..	50 & 60	40 to 60	50 & 60
Bristol	90	66	66 & 50	50
New Haven	207	50 to 70	50 to 70	50 to 70
Wallingford	25	60 to 80	60 to 70	50 to 60
Delaware:				
Wilmington	152	65 to 80	49 & 65	50 & 60
Georgia:				
La Grange	81	46 & over	80	56, 60 & 75
Idaho:				
Boise	70	80	52(a)	40 & 30(a)
Illinois:				
Altoona	80	42	30 to 42	24 to 30
Canton	53	66	70	60
Champaign	75	66	66	66
Chicago	3,300	66 to 141	66	66
East St. Louis	192	66	60	60
Joliet	85	66	80	66
Kewanee	69	80	80	60
Oak Park	100	38 to 50	40 to 76	30
Indiana:				
Anderson	117	50 to 72	28 to 44(a)	24 to 32(a)
Bloomington	75	60	82.5	50
Elkhart	115	66	66 & 82.5	50
Elwood	70	66	66	50 & 60
Fort Wayne	274	66	66	40 to 60
Huntington	53	60 to 66	66	50 to 66
Lafayette	94	60	60	50 & 60
Muncie	175	50	60	50
Peru	80	80	100	70
Richmond	71	80	66	50 to 66
South Bend	..	82.5	82.5 & 100	60
Vincennes	68	50	50	50 to 75
Iowa:				
Boone	70	70 & 80	70 & 80	70 & 80
Cedar Rapids	146	80	80 to 120	60
Clinton	98	100 to 140	100 & 80	60 to 80
Davenport	188	80	80	50 to 60
Des Moines	600	66 to 80	66 to 70	40 to 66
Keokuk	80	100	100	66
Marshalltown	68	80	66	60
Waterloo	209	80	80	60 & 66
Kansas:				
Emporia	85	36 to 68	30 to 40	26 to 30
Hutchinson	115	112	120	80
Leavenworth	200	40	40	30
Pittsburg	80	40 to 50(a)	60 to 76(a)	24 to 30(a)
Salina	90	80 to 100	80 to 100	60
Wichita	450	80 to 100	70 to 90	50 to 70
Kentucky:				
Ashland	93	100	80 to 100	40 to 80
Covington	60	66	66	50
Henderson	50	100	100	50 to 100
Owensboro	100	66	66 to 80	50 to 66
Louisiana:				
Lake Charles	110	60	40 to 60	40 to 60
Maine:				
Bangor	117	100	80	60
Waterville	47	66	66	50
Maryland:				
Hagerstown	70	50	50	60
Massachusetts:				
Brockton	250	50 to 70	40 to 70	40 to 60
Brookline	73	75 to 160	65	40 to 50
Cambridge	125	60 to 70	80 to 100	40 to 50
Chicopee	75	50	50	50
Gardner	80	50	80	40
Medford	90	50 to 60	50 to 70	40
Methuen	130	66	50	40
New Bedford	205	40 to 80(b)	40 to 80(b)	40 & 50
North Adams	71	66	33 to 66	33 to 50

CITY STREETS—Continued

City	Total miles within city limits	Average width between property lines: Main thoroughfares	Business	Residence
Massachusetts (Continued):				
Northampton	175	80	80	40
Peabody	76	70	50 to 60	40 to 50
Saugus	75	60	60	40
Taunton	155	50 to 66	60 to 70	40
Watertown	61	60 to 100	50 & 66	40 & 50
Winchester	60	60	60 to 70	40 to 45
Worcester	437	60	45	50
Michigan:				
Ann Arbor	65	66	66(c)	60
Battle Creek	120	66	66	49.5 & 66
Grand Rapids	323	66	66	66
Ironwood	50	66	60	50
Owosso	80	99	66	66(d)
Pontiac	120	66 to 100	50 to 66	50
Port Huron	150	66 & 100	100	66
Sault Ste. Marie	55	66	80	66
Traverse City	50	66	66	66
Minnesota:				
Duluth	1,000	66	66(e)	66
Faribault	62	46	50	36
Minneapolis	881	80 to 100	80 to 102	60 to 80
Rochester	62	66 to 100	77 to 100	45 to 100
Winona	..	70 to 100	70	70
Mississippi:				
Columbus	50	100	80	40
Hattiesburg	77	60	50	30 to 100
Missouri:				
Kansas City	1,350	60	70	50
Moberly	60	60	80	50
St. Louis	988	60(f)	60(f)	60(f)
Montana:				
Billings	65	80	80	60 to 80
Butte	97	70	70	60
Missoula	110	80	99	80
Nebraska:				
North Platte	34	66	80(g)	80(g)
Nevada:				
Reno	41	80	80	60
New Hampshire:				
Concord	47	66	100	50 & 60
Keene	44	50 to 140	40 to 140	40 to 66
Manchester	198	50 to 100	50	50
New Jersey:				
Bayonne	62	60	70	60 & 70
Bloomfield	68	75 to 80	60	50
Bridgeton	50	66	60	50 & 60
Irvington	..	30 to 50(a)	30 to 50(a)	26 to 30(a)
New Brunswick	59	66 to 100	40 to 66	60
Perth Amboy	..	66	60	60
Plainfield	95	66	50 to 60	50 to 60
Summit	54	50 to 66	50 to 60	40 to 50
West New York	23	75	60	50
New Mexico:				
Albuquerque	75	80	60 & 80	60
New York:				
Amsterdam	..	60 to 80	60	50
Auburn	87	66	66 to 99	49.5
Buffalo	678	66 to 99	66	60 to 66
Cortland	40	100	66 to 100	50 to 66
Dunkirk	48	66	66(h)	50 & 66
Elmira	122	66	66	50
Fulton	43	66(i)	66	66
Glens Falls	42	66	50 & 66	50
Gloversville	53	50 & 55	50 & 55	50
Herkimer	22	66	66	50
Ilion	27	60	50	60
Little Falls	25	60	60	40 to 80
Lockport	83	66 & 82	66	66
New York	4,000	100	60	60
Niagara Falls	135	66	66 & 99	60 & 66
No. Tonawanda	64	66 to 90	66	50 to 66
Olean	65	100	100	60
Oswego	85	100	100	100
Syracuse	300	80 to 100	66 to 100	50
Troy	105	60 to 70	60	60 to 80
Utica	150	66 to 100	66	50 to 66
North Carolina:				
Durham	90	46	56	46
Raleigh	77	99	66	60
Rocky Mount	130	36	60	60
Wilmington	75	66	66	66
Wilson	..	60	50	40 to 50
North Dakota:				
Fargo	103	90	80	80
Grand Forks	59	60 to 100	80	60 to 100
Minot	76	66 to 80	66 to 80	50 to 60
Ohio:				
Akron	412	65	85	45
Alliance	74	60	80	50
Ashtabula	84	60	80	60
Bucyrus	52	82.5	66	50
Columbus	..	60 to 90	82.5	50 to 60
Dayton	275	99	99	50 to 60
Elyria	64	66 & 99	66	50 to 66
Findlay	..	100	66	60
Kenmore	75	100	60	45 & 50

CITY STREETS—Continued

City	Total miles within city limits	Average width between property lines: Main thoroughfares	Business	Residence
Ohio (Continued):				
Lakewood	88	100 & 120	66 & 80	50
Lancaster	70	66 & 82.5	82.5	50
Lima	100	80	66	50
Mansfield	74	60	60	50
Massillon	75	80	66 to 80	50
Newark	80	60	99	50
Niles	..	60	60	50
Tiffin	..	70	68	60
Zanesville	84	66	66	40 to 60
Oklahoma:				
Chickasha	124	80	100	60 & 80
Enid	200	100	100	66
Muskogee	180	80	90	60
Sapulpa	..	56	48 to 56	26 to 36
Tulsa	126	70	80	55
Oregon:				
Eugene	75	66	66	66
Portland	1,215	60 to 80	60 to 80	50 to 60
Pennsylvania:				
Altoona	100	50(k)	50	40 & 50
Bethlehem	128	70	60 to 90	60
Butler	77	60 to 80	80	40 to 60
College Hill	11	60	60	60
Connellsville	39	40 to 60	40 to 60	30 to 60
Du Bois	33	50	60	40
Greensburg	28	50 to 60	40 to 50	40 to 50
Hazleton	104	60 & 100	40 to 100	40 to 60
Mahonoy City	8	80	50	40
Meadville	47(l)	50	50	50
Monessen	15	50	40 & 50	40 & 50
New Castle	100	50	45 to 80	50 & 60
Norristown	68	36(a)	50(a)	26 & 36(a)
Oil City	64	40 to 60	40 to 60	40 to 60
Pittston	..	50	60	40
Rankin	11	40 to 50	40 to 50	40 to 50
Sharon	50(m)	50 & 60	45 & 60	40 & 50
Uniontown	50	55 to 60	50	40 to 50
Wilkinsburg	43	60	50 to 60	40 to 60
Williamsport	120	60 to 75	60	60
Rhode Island:				
Pawtucket	102(m)	50 to 60	50 to 60	40 to 50
Providence	279	50	50	50
South Carolina:				
Charleston	75	45 to 70	50	40 & 50
Florence	40	..	70	60
Tennessee:				
Jackson	150	50 & 60	90	35 to 50
Johnson City	71	60	50	50
Nashville	342	50	50	50
Texas:				
Corsicana	200	60	80	50
Dallas	550	..	80	50 & 60
Denison	..	80	80 & 100	70
El Paso	200	70	70	70
Houston	1,200	80 to 100	80	60
Palestine	75	60	60	50
Utah:				
Ogden	200	99 & 132	99 & 132	60 to 99
Vermont:				
Barre	..	49.5	60	33 & 49.5
Virginia:				
Richmond	381	70(n)	66 to 80	50 & 60
Staunton	30	40	40	30 & 40
Washington:				
Seattle	1,350	66	80 & 90	40 & over
Spokane	..	75	75	60
Walla Walla	65	60 & 80	80 & 100	60 & 80
Yakima	75	100	100	80
West Virginia:				
Bluefield	25	60	50	40
Clarksburg	65	60	50	40
Fairmont	55	60 to 70	60	30 to 60
Wisconsin:				
Appleton	210	96	60	60
Ashland	40	66	66	66
Beloit	80	66	80	60
Fond du Lac	..	66	66	60
Green Bay	159	60 & 80	60 & 80	60 & 80
Janesville	90	66 to 100	66 to 84	50 to 66
Kenosha	117	60	60	50
La Crosse	118	80	66	66
Manitowoc	56	66 & 80	66 & 80	60 to 70
Marinette	85	50 to 100	50 to 66	50 to 100
Oshkosh	1"5	60	60 to 80	60
Wyoming:				
Casper	80	80	70 to 80	60

(a)— Between curbs. (b)—Mostly 40. (c)—One 82.5 ft. (d)—A few 49.5 ft. (e)—One 80 ft. (f)—80% of streets are 60 ft. or less, others from 80 to 150, this applying to all classes of streets. (g)—Business streets 52 ft. curb to curb, residence 46 ft. curb to curb. (h)—One 80 ft. (i)—Some 76 and 100 ft. (k)—Some 60, 70 and 90 ft. wide. (l)—Includes alleys. (m)—Improved streets. (n)—Five streets average 100 ft.

STREET WIDENING

City	Widened because of traffic: Have any been?	Cost	Under construction: Are there any?	Estimated cost	Widening proposed, and estimated cost
Alabama					None
Birmingham	Yes	$50,000	Yes	$35,000	Bids received for 1 block
Montgomery	.....	.....	.....	.....	
Arkansas					
Fort Smith	Yes	25,000	.....	.....	.....
California					Yes
Berkeley	2 blocks 10 ft.	60,000(a)	No	.....	Estimated cost $1,000,000
Glendale	Yes	Not yet assessed	Yes	200,000	35 major projects
Los Angeles	Yes	.....	Several big projects	.....	
Pasadena	Yes	.....	Yes	.....	$38,000 for property
Richmond	Yes	.....	Obtaining property	.....	$500,000
Santa Monica	Between curbs	.....	Between curbs	.....	
Colorado					.....
Colorado Spgs.	Yes	$5,000	No	.....	
Connecticut					$30,000
Bristol	Yes	10,000	No	.....	$200,000
New Haven	Yes	.....	No	.....	.....
Wallingford	Yes	15,000(b)	No	.....	
Delaware					None
Wilmington	Yes	.....	Narrowing sidewalks	10,000	Narrow sidewalks on several streets
Illinois					
Champaign	Yes	30,000	No	.....	None
Chicago	Yes	89,000,000	Several	.....	.....
E. St. Louis	No	.....	No	.....	$100,000
Oak Park	Yes	260,483(a)	Yes	128,000	.....
Indiana					One street, $13,000
Elkhart	No	.....	No	.....	.....
Fort Wayne	Yes	25,274	No	.....	.....
Richmond	Yes	.....	Yes	.....	Several
South Bend	Some roadways	.....	No	.....	
Iowa					Two blocks
Clinton	Roadways	.....	No	.....	.....
Des Moines	Yes	500,000	Yes	200,000	.....
Waterloo	Corner radii increased	125 each	No	.....	
Kansas					.....
Hutchinson	Roadway	6,400	Yes	6,400	Yes
Wichita	Yes	50,000	No	.....	
Massachusetts					Three, $312,500
Brockton	Yes	525,000	No	.....	.....
Brookline	Yes	300,000	No	.....	.....
Gardner	Yes	20,000	Yes	25,000	$500,000
Medford	Yes	100,000	No	.....	.....
Methuen	No	.....	Yes	.....	.....
New Bedford	Yes	1,500,000	Yes	.....	Yes
Watertown	Yes	.....	No	.....	$100,000
Winchester	One	.....	No	.....	One
Michigan					.....
Grand Rapids	No	.....	No	.....	2 streets, $567,000
Pontiac	No	.....	No	.....	$290,000
Sault Ste. Marie	Yes	$10,000	Yes	50,000	25,000
Minnesota					.....
Duluth	No	.....	Yes	304,000	1,146,000
Minneapolis	Yes	2,500,000	Yes	.....	
Missouri					20,000,000
Kansas City	Yes	3,000,000	Yes	1,000,000	None
Moberly	Yes	40,000	Yes	50,000	.....
St. Louis	Yes	.....	Yes	30,000,000	

STREET WIDENING—(Continued)

City	Widened because of traffic: Have any been?	Cost	Under construction: Are there any?	Estimated cost	Widening proposed, and estimated cost
New Jersey					
Bayonne	No	.....	Yes	250,000	.....
Bloomfield	Yes	.....	Yes	.....	.....
New Brunswk.	Yes	100,000	No	.....	$300,000
Plainfield	Yes	60,000	No	.....	.....
Summit	No	.....	No	.....	Two projects
New York					
Amsterdam	One	.....	No	.....	.....
Buffalo	Yes	.....	Yes	.....	Yes
Elmira	Roadways only	12,000	Roadway	7,000	$6,000
Herkimer	No	.....	No	.....	20,000
New York	Yes	.....	Yes	.....	Several; one est. $5,000,000
Utica	Yes	.....	Yes	65,000	.....
No. Carolina:					
Durham	Yes	300,000	No	.....	100,000
Rocky Mount	Yes	.....	No	.....	.....
No. Dakota:					
Fargo	Roadway	3,000	No	.....	No
Ohio:					
Akron	Yes	250,000	No	.....	.....
Alliance	Yes	150,000	Yes	150,000	.....
Columbus	Roadways	.....	Roadway	32,000	$100,000
Dayton	Roadways	80,000	....	.....	.....
Massillon	Yes	.....	No	.....	.....
Oklahoma:					
Sapulpa	One	.....	One, 20 ft.	12,000	.....
Tulsa	Roadways	.....	Roadways	134,140	225,500
Oregon:					
Eugene	Roadways only	.....	Roadway	2,000	Several, about $700 per block
Portland	Yes	.....	No	.....	$1,316,000
Pennsylvania:					
Butler	Yes	10,000	Yes	12,000	.....
New Castle	Roadway only	.....	1 roadway	2,800	.....
Oil City	No	.....	Yes	175,000	.....
Philadelphia	Yes	.....	....	.....	.....
Wilkinsburg	Yes	300,000	Yes	300,000	300,000
Uniontown	Yes	300,000	Yes	300,000	.....
Rhode Island:					
Pawtucket	Yes	.....	No	.....	.....
Providence	Yes	.....	Yes	.....	None
Tennessee:					
Johnson City	Roadways only	.....	No	.....	.....
Nashville	One	.....	.....	.....	$200,000
Texas:					
Dallas	Yes	.....	Yes	1,250,000	Yes
El Paso	½ block	75,000	No	.....	Yes
Houston	Roadways only	.....	.....	.....	.....
Palestine	No	.....	No	.....	Roadway, $6,000
Virginia:					
Richmond	Yes	200,000	Two	.....	Seven
Staunton	Yes	2,500	No	.....	No
Washington:					
Seattle	Yes	.....	.....	.....	.....
W. Virginia:					
Bluefield	.....	.....	Widening roadway3ft.	330,000	.....
Clarksburg	Yes	10,000	Yes	1,500	$6,000
Wisconsin:					
Kenosha	.....	.....	.....	.....	Two, $200,000

a—Including repaving. b—No buildings moved.

CITY PLANNING

City	Has city a planning commission?	Comprehensive City Plan: When prepared?	Comprehensive City Plan: Features carried out	Official plan of future street layout	Has City Made: Traffic counts for street planning?	Has City Made: Special traffic studies?
Alabama:						
Montgomery	No	None	.....	.....	.....	Yes
Arkansas:						
Fort Smtih	No	None	.....	Rectangular plan adopted	No	No
California:						
Bakersfield	Yes	None	Use zoning adopted	.....	At R.R. crossings	.....
Berkeley	Yes	Partial	Parking spaces, set-back lines, zoning	Being studied	Will do so	Electric & auto transporation
Glendale	Yes	None	.....	.....	No	By Traffic Com.
Los Angeles	Yes	Now	Major highways, civic center, parks reservations, zoning	Whole plan being worked out	Some	Official & unofficial
Pasadena	Yes	1923	Civic center, street widening & extensions	Yes	On May 24	Preliminary, for traffic signal installation
Richmond	Yes	1923	Zoning	Yes	Yes	No
Riverside	Yes	None	.....	Yes	Some	No
Santa Ana	Yes	None	.....	Yes	No	.....
Santa Monica	No	None	.....	Contemplated	No	Yes
Colorado:						
Boulder	Yes	1915	Width of paved streets, parks, bridges	By Planning and Parks Com'n.	Yes	No
Denver	Zoni'g Com.	None	.....	No	No	No
Pueblo	No	1920	None	.....	No	No
Connecticut:						
Bridgeport	Yes	1914	Very little	No	Yes	Yes
Bristol	Yes	1920	One street built	Yes	No	No
New Haven	Yes	None	.....	No	Yes	Yes
Delaware						
Wilmington	No	None	.....	Yes	.....	.....
Illinois:						
Alton	No	1913	None	No	No	No
Canton	No	None	.....	Yes	No	No
Champaign	Zoni'g Com.	None	.....	No	No	No
Chicago	Advisory	Outline in 1910	Widening and opening principal thorofares	Plan Com'n. now drafting major street plan	Yes	Yes
East St. Louis	No	1918	Roads on N. & S. sides of city to eliminate grade crossings	No	No	Yes
Joliet	No	1916	None	No	No	No
Oak Park	Yes	Now	Planning just begun	Yes	Yes	Yes

City	Has city a planning commission?	Comprehensive City Plan: When prepared?	Comprehensive City Plan: Features carried out	Official plan of future street layout	Has City Made: Traffic counts for street planning?	Has City Made: Special traffic studies?
Indiana:						
Anderson	Yes	1923	None	Yes	No	No
Elkhart	Yes	1922	None	.....	No	No
Fort Wayne	No	None	.....	No	.....	Yes
Muncie	Yes	Now	.....	.....	.....	Yes
Peru	No	None	.....	No	Yes	No
Richmond	Yes	None	.....	Partial	No	No
South Bend	Yes	1923	New diagonal streets, designated major traffic streets, increased width of some streets to 80 ft. min., are opening several streets.	Yes	No	No
Iowa						
Boone	Never functioned	1921	Very little	No	Yes	.....
Cedar Rapids	Yes	.....	Zoning plan in preparation	.....	.....	.....
Clinton	No	None	.....	Yes	No	At R. R. crossings
Davenport	Yes	None	.....	No	No	No
Des Moines	Yes	Now	.....	Under way	Yes	Yes
Keokuk	No	1913	None	No	No	No
Waterloo	No	?	None	No	Some	Yes
Kansas						
Hutchinson	Yes	1922	Zoning	.....	.....	Yes
Pittsburg	.....	.....	.....	Yes	Yes	Yes
Salina	Yes	None	.....	No	No	No
Wichita	Yes	1922	Zoning; some street opening and widening	Yes	Some	Yes
Louisiana						
Lake Charles	Yes	1921	New building lines for street widening	Yes	.....	.....
Maine						
Bangor	No	None	.....	No	Yes	No
Massachusetts						
Brockton	Yes	None	.....	Yes	Yes	Yes
Brookline	Yes	None	.....	Being considered	No	No
Cambridge	Yes	None	.....	No	No	A few
Chicopee	Yes	.....	Contract for zoning made	No	Few	No
Gardner	No	1921	None	Partial	Yes	No
Medford	Yes	Now	.....	No	No	No
Methuen	Yes	None	.....	No	Yes	No
New Bedford	Yes	None	.....	About 70 miles	Some	Yes
North Adams	Yes	1923	None	No	Yes	Yes
Northampton	Yes	1923	None	No	No	No
Saugus	Yes	None	.....	No	No	No
Taunton	Yes	None	.....	No	No	No
Watertown	Yes	1902	.....	No	Yes	Yes
Winchester	Yes	Now	.....	Being prepared	.....	.....
Worcester	Yes	1923	None	No	Yes	Yes
Michigan						
Ann Arbor	No	1920	Opening new streets	No	No	No
Grand Rapids	Yes	1921-4	Zoning, major street, transit and recreation plans	Major streets and grade separation	By Boy Scouts	Yes
Pontiac	Yes	1923	Park and cemetery work	Yes	Yes	Yes
Sault Ste Marie	Yes	None	.....	No	Yes	Some
Minnesota						
Duluth	Yes	None	.....	Being prepared	Some	Some
Minneapolis	Yes	1917	Street extensions	Being prepared	Yes	Yes
Rochester	No	None	.....	No	No	By police and city engineer
Missouri						
Kansas City	Yes	1923	Zoning	No	Yes	Yes
St. Louis	Yes	Now	Street widening, extension and cut-offs; land platting; transit plan; zoning ordinance	Major street plan	Yes	Yes
New Hampshire						
Concord	No	None	.....	No	By police	Business streets
Keene	No	None	.....	No	No	Re. parking and circular traffic
Manchester	Yes	None	.....	No	No	No
New Jersey						
Bayonne	Yes	1923	None	Yes	Yes	Yes
Bridgeton	No	None	.....	No	No	Police Dept.
Irvington	No	1918	None	No	Yes	Yes
New Brunswick	Yes	Now	.....	Under preparation	Yes	Yes
Perth Amboy	Yes	None	.....	No	No	No
Summit	Yes	Now	.....	Under preparation	Some(a)	Some(a)
West New York	Yes	None	.....	No	No	No
New York						
Amsterdam	No	None	.....	No	.....	Yes
Buffalo	Yes	1922	None	No	Yes	Yes
Elmira	Yes	None	.....	Yes	No	No
Gloversville	No	None	.....	No	No	Yes
Herkimer	No	None	.....	No	No	Some
New York	Yes	1811 to date	City more than 87% finally and tentatively mapped	Yes	Yes	Being made continually
Niagara Falls	No	1917	None	No	No	No
No. Tonawanda	No	1921	None	.....	No	No
Olean	Temporary	None	.....	.....	No	Some
Oswego	No	(b)	.....	Yes	No	No
Syracuse	Yes	1922	Entire city zoned; in newer portions streets conformed to plan	Yes; and 3 mi. beyond city limits in preparation	No	Beginning
Troy	Yes	1892	Width of streets in old section	Partial	Yes	Yes
Utica	Yes	1922	Major street plan	.....	Yes	.....
North Carolina						
Durham	Yes	None	.....	No	No	Yes(c)
Raleigh	Yes	1922	Heights and area zoning	No	No	Yes(d)
Rocky Mount	No	1923	.....	Some	Yes	Yes
Wilmington	Yes	Now	.....	.....	Yes	Some

City	Has city a planning commission?	Comprehensive City Plan: When prepared?	Comprehensive City Plan: Features carried out	Official plan of future street layout	Has City Made: Traffic counts for street planning?	Has City Made: Special traffic studies?
North Dakota						
Fargo	Advisory	1920	Preliminary report only	No	No	Police Dept.
Grand Forks	No	1915	None	No	No	No
Ohio						
Akron	Yes	None	.....	No	No	Yes
Alliance	Yes	None	.....	No	No	No
Ashtabula	Yes	1923	Zoning and building restrictions	Yes	No	No
Columbus	Yes	Partial	.....	Partial	In progress	Will this year
Dayton	Yes	None	.....	Will this year	No	.....
Findlay	.....	None	.....	No	No	Yes
Lakewood	Yes	None	.....	Streets 95% developed	No	Police Dept.
Lancaster	Ordinance just passed	None	.....	Scattered sections	One thorofare	No
Mansfield	Yes	None	.....	No	No	No
Massillon	Yes	None	.....	Tentative	Some	Yes
Niles	Yes	.....	.....	New sub-divisions	No	No
Zanesville	Yes	None	.....	No	No	Yes
Oklahoma						
Tulsa	Yes	1923 Partial	Zoning Ordinance; major street plan	3 mi. beyond city limits	Yes	Yes
Oregon						
Eugene	No	Partial 1916	Width of roadways	.....	For widening	General
Portland	Yes	1921	Used in street platting	No	Yearly	Yes
Pennsylvania						
Altoona	Yes	None	.....	No	No	Begun
Bethlehem	Yes	1919	Parks and street widening	Yes	No	Yes
Butler	Yes	1918	Grading, paving, lighting, sewers	Yes	Yes	Yes
Connellsville	Yes	1914	Sewerage	No	No	No
DuBois	Yes	None	.....	No	No	No
Hazleton	Yes	.....	.....	1870 plan being followed	No	No
Meadville	Yes	None	.....	Yes	No	No
Monessen	Yes	Now	.....	Beginning	.....	.....
New Castle	Yes	None	.....	No	No	No
Norristown	No	None	.....	.....	No	Police Dept.
Oil City	Yes	None	.....	No	No	No
Philadelphia	.....	.....	.....	.....	By Bureau of Highways	By several bureaus
Pittston	Yes	?	None	No	No	No
Sharon	Yes	None	.....	No	Yes	No
Uniontown	Yes	None	.....	No	No	No
Wilkinsburg	Yes	None	.....	Yes	No	Yes
Williamsport	Yes	Now	Sub-division layouts, street extensions and widening	Main arteries	Yes	.....
Rhode Island						
Pawtucket	No	None	.....	No	No	A few
Providence	Yes	1921	None	No	No	Police service engineer
South Carolina						
Florence	Just appointed	None	.....	No	No	No
Tennessee						
Johnson City	No	None	.....	Small section	Will soon	Will soon
Nashville	No	None	.....	.....	.....	Street car rerouting; one-way traffic
Texas						
Corsicana	No	None	.....	Yes	Yes	Yes
Dallas	Yes	1911	Large part	Yes	Some	Yes
El Paso	Yes	1923	Grade crossing elimination; parks; new thorofares	Main thorofare	Yes	Yes
Houston	Yes	None	.....	No	No	No
Palestine	No	None	.....	No	Some	Some
Vermont						
Barre	No	None	.....	No	A few	No
Virginia						
Richmond	No(e)	None	.....	Territory adjacent to city	Yes	Yes
Staunton	No	None	.....	No	No	For restricting parking
Washington						
Seattle	No	1911	Used in planning work by city engineer	Being studied	Extensive	Extensive
Spokane	Not functioning	None	.....	No	No	No
Yakima	No	Partial	New streets opened	.....	No	No
West Virginia						
Bluefield	Yes	None	.....	No	No	No
Clarksburg	No	None	.....	No	No	Yes
Fairmont	No	None	.....	No	Business streets	Police
Wisconsin						
Appleton	Yes	1922	Zoning and civic center	Made, not adopted	Yes	Yes
Ashland	No	None	.....	No	.....	Police Dept.
Beloit	Yes	1921	Land purchased for park and drainage	Yes	Yes	No
Green Bay	Yes	1920	Some parking	Yes	No	No
Janesville	Yes	1920	Straightening streets; zoning	Part	Few	At grade crossings
Kenosha	Yes	1923	Zone ordinance, major street plan, civic center	Major streets	Yes	Yes
La Crosse	No	1914	Zoning	No	Yes	Yes
Manitowoc	Yes	Now	.....	No	No	No
Marinette	Yes	None	.....	No	No	No
Oshkosh	Yes	Now	.....	No	.....	Yes

(a)—Will make more in connection with planning now under way. (b)—Map made in 1814, with streets 100 ft. wide for fire protection. In residence part, 66 ft. used as street, 17 ft. on each side as lawn, to be recovered when needed. (c)—With little definite result. (d)—As a result, new west and north thorofares planned and latter under way. (e)—Considerable work done by city engineers during past two years under special appropriations.